



No. 132

This certifies that four hundred and fifty copies only, all on hand-made Holland paper and printed from types, of this edition of Moxon's "Mechanick Exercises," in two volumes, were completed in August, 1896, and that the types have been distributed.

Joseph J. Little.

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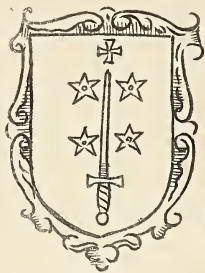
David Williams.

W. W. Pasko.

Committee of the Typothetae.

MOXON'S
MECHANICK EXERCISES

*The true Effigies of Laurenz Ians. Koster. Delineated
from his Monumentall Stone Statue, Erected at
Harlem.*



MEMORIA
SACRVM

LAVRENTIO
COSTERO,
HARLEMENSI,
ALTERI CADMO,
ET ARTIS
TYPOGRAPHICÆ
CIRCA AN. DCM.
M. CCCC. XXX.
INVENTORI
PRIMO,

BENE DE LITERIS
AC TO TO ORBE
MERENTI, HANC
C. L. C. C.

STATVAM, QVIA
ÆREA AVT MAR-
MOREA DE EVIL-
IRO MONVME-
TO POSVIT CIVIS
GRATISSIMVS

PETRVS
SCHRIEVERIVS

1635.

*The true Effigies of Iohn Guttemberg Delineated from
the Original Painting at Mentz in Germanie.*



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Joseph Moxon

MOXON'S MECHANICK EXERCISES,

OR THE DOCTRINE OF HANDY-WORKS
APPLIED TO THE ART OF

PRINTING

A LITERAL REPRINT IN TWO VOLUMES OF
THE FIRST EDITION PUBLISHED IN THE YEAR 1683

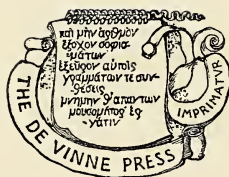
WITH PREFACE AND NOTES BY
THEO. L. DE VINNE

VOLUME I



NEW-YORK
THE TYPOTHETÆ OF THE CITY OF NEW-YORK
MDCCCLXXXVI 1896

OFFICE LIBRARY
OF THE
Smithsonian Institution.



PREFACE

JOSEPH MOXON was born at Wakefield in Yorkshire, England, August 8, 1627. There is no published record of his parentage or his early education. His first business was that of a maker and vender of mathematical instruments, in which industry he earned a memorable reputation between the years 1659 and 1683. He was not content with this work, for he had leanings to other branches of the mechanic arts, and especially toward the designing of letters and the making of printing-types.

In 1669 he published a sheet in folio under the heading of "Prooves of the Several Sorts of Letters Cast by Joseph Moxon." The imprint is "Westminster, Printed by Joseph Moxon, in Russell street, at the Sign of the Atlas, 1669." This specimen of types seems to have been printed, not to show his dexterity as a type-founder, but to advertise himself as a dealer in mathematical and scien-

tific instruments. The reading matter of the sheet describes "Globes Celestial and Terrestrial, Large Maps of the World, A Tutor to Astronomie and to Geographie" — all of his own production. Reed flouts the typography of this sheet: "It is a sorry performance. Only one fount, the Pica, has any pretensions to elegance or regularity. The others are so clumsily cut or badly cast, and so wretchedly printed, as here and there to be almost undecipherable."¹ The rude workmanship of these early types proves, as he afterward admitted, that he had never been properly taught the art of type-founding; that he had learned it, as he said others had, "of his own genuine inclination."

It was then a difficult task to learn any valuable trade. The Star Chamber decree of 1637 ordained that there should be but four type-founders for the kingdom of Great Britain, and the number of their apprentices was restricted. When the Long Parliament met in 1640, the decrees of the Star Chamber were practically dead letters, and for a few years there was free trade in typography. In 1644 the Star Chamber regulations were reimposed; in 1662 they were made more rigorous than ever. The importation of types from abroad without the consent of the Stationers' Company was prohibited. British

¹ "A History of the Old English Letter Foundries, with Notes Historical and Biographical on the Rise and Progress of English Typography." By Talbot Baines Reed, London, 1887, p. 181.

printers were compelled to buy the inferior types of English founders, who, secure in their monopoly, did but little for the improvement of printing.¹

It is probable that the attention of Moxon was first drawn to type-founding by the founders themselves, who had to employ mechanics of skill for the making of their molds and other implements of type-casting. In this manner he could have obtained an insight into the mysteries of the art that had been carefully concealed. He did not learn type-making or printing in the usual routine. The records of the Company of Stationers do not show that he was ever made a freeman of that guild, yet he openly carried on the two distinct businesses of type-founding and printing after 1669. It is probable that he had a special permit from a higher authority, for in 1665 he had been appointed hydrographer to the king, and a good salary was given with the office. He was then devoted to the practical side of scientific pursuits, and was deferred to as a man of ability.

He published several mathematical treatises between the years 1658 and 1687; one, called "*Compendium Euclidis Curiosum*," was translated by him

¹ The four founders appointed by the Star Chamber did not thrive. One of them, Arthur Nicholls, said of himself: "Of so small benefitt hath his Art bine that for 4 yeares worke and practice he hath not taken above 48£, and had it not bine for other impymente he might have perrisht." Reed, p. 168.

from Dutch into English, and printed in London in 1677. Mores supposes that he had acquired a knowledge of Dutch by residence in Holland, but intimates that he was not proficient in its grammar.¹

In 1676 he published a book on the shapes of letters, with this formidable title: “*Regulæ Trium Ordinum Literarum Typographicarum; or the Rules of the Three Orders of Print Letters, viz: the Roman, Italick, English—Capitals and Small; showing how they are Compounded of Geometrick Figures, and mostly made by Rule and Compass. Useful for Writing Masters, Painters, Carvers, Masons and others that are Lovers of Curiosity. By Joseph Moxon, Hydrographer to the King’s Most Excellent Majesty. Printed for Joseph Moxon on Ludgate Hill, at the Sign of Atlas, 1676.*” He then dedicated the book to Sir Christopher Wren, “as a lover of rule and proportion,” or to one who might be pleased with this attempt to make alphabetical letters conform to geometric rules.

There is no intimation that the book was intended for punch-cutters. It contains specific directions about the shapes of letters, covering fifty-two pages, as proper introduction to the thirty-eight pages of model letters that follow, rudely drawn and printed from copper plates. Moxon says that these model

¹ “A Dissertation upon English Typographical Founders and Founderies.” By Edward Rowe Mores, A. M. & A. S. S. [London], 1778. 8vo, p. 43.

letters are his copies of the letters of Christopher Van Dijk, the famous punch-cutter of Holland. He advises that each letter should be plotted upon a framework of small squares—forty-two squares in height and of a proportionate width, as is distinctly shown in the plates of letters in this book.¹ Upon these squares the draftsman should draw circles, angles, and straight lines, as are fully set forth in the instructions.

These diagrams, with their accompanying instruction, have afforded much amusement to type-founders. All of them unite in saying that the forming of letters by geometrical rule is absurd and impracticable. This proposition must be conceded without debate, but the general disparagement of all the letters, in which even Reed joins, may be safely controverted. It is admitted that the characters are rudely drawn, and many have faults of disproportion; but it must not be forgotten that they were designed to meet the most important requirement of a reader—to be read, and read easily. Here are the broad hair-line, the stubby serif on the lower-case and the bracketed serif on the capitals, the thick stem, the strong and low crown on letters like *m* and *n*, with other peculiarities now commended in old-style faces and often erroneously regarded as the original devices of the first Caslon. The black-letter has more merit

¹ See plates Nos. 11 to 17.

than the roman or italic. Some of the capitals are really uncouth ; but with all their faults the general effect of a composition in these letters will be found more satisfactory to the bibliophile as a text-type than any form of pointed black that has been devised in this century as an improvement.

Moxon confesses no obligation to any one for his geometrical system, but earlier writers had propounded a similar theory. Books on the true proportions of letters had been written by Fra Luca Paccioli, Venice, 1509; Albert Dürer, Nuremberg, 1525; Geofroy Tory, Paris, 1529; and Yciar, Saragossa, 1548. Nor did the attempt to make letters conform to geometrical rules end with Moxon. In 1694, M. Jaugeon, chief of the commission appointed by the Academy of Sciences of Paris, formulated a system that required a plot of 2304 little squares for the accurate construction of every full-bodied capital letter. The manuscript and diagrams of the author were never put in print, but are still preserved in the papers of the Academy.

This essay on the forms of letters seems to have been sent out as the forerunner of a larger work on the theory and practice of mechanical arts. Under the general title of "Mechanick Exercises," in 1677, he began the publication, in fourteen monthly numbers, of treatises on the trades of the smith, the joiner, the carpenter, and the turner. These constitute the first volume of the "Mechanick Exercises."

The book did not find as many buyers as had been expected. Moxon attributed its slow sale to political excitement, for the Oates plot put the buying and study of trade books away from the minds of readers. He had to wait until 1683 before he began the publication of the second volume, which consists of twenty-four numbers, and treats of the art of printing only. It is this second volume that is here reprinted, for the first volume is of slight interest to the printer or man of letters.

Moxon's book has the distinction of being not only the first, but the most complete of the few early manuals of typography. Fournier's "*Manuel Typographique*" of 1764 is the only book that can be compared with it in minuteness of detail concerning type-making, but he treats of type-making only. Reed says: "Any one acquainted with the modern practice of punch-cutting cannot but be struck, on reading the directions laid down in the '*Mechanick Exercises*,' with the slightness of the changes which the manual processes of that art have undergone during the last two centuries. Indeed, allowing for improvements in tools, and the greater variety of gauges, we might almost assert that the punch-cutter of Moxon's day knew scarcely less than the punch-cutter of our day, with the accumulated experience of two hundred years, could teach him. . . . For almost a century it remained the only authority on the subject; subsequently it

formed the basis of numerous other treatises both at home and abroad; and to this day it is quoted and referred to, not only by the antiquary, who desires to learn what the art once was, but by the practical printer, who may still on many subjects gather from it much advice and information as to what it should still be.”¹

During his business life, Moxon stood at the head of the trade in England. He was selected to cut a font of type for an edition of the New Testament in the Irish language, which font was afterward used for many other books. He cut also the characters designed by Bishop John Wilkins for his “*Essay towards a Real Character and a Philosophical Language*,” and many mathematical and astronomical symbols. Rowe Mores, who describes him as an excellent artist and an admirable mechanic, says that he was elected a Fellow of the Royal Society in 1678.² There is no known record of the date of his death. Mores gives the year 1683 as the date of his relinquishment of the business of type-making, but he was active as a writer and a publisher for some years after.

The first volume of the “*Mechanick Exercises*,” concerning carpentry, etc., went to its third edition in 1703, but the second volume, about printing, has been neglected for two centuries. During this long

¹ Reed, “*Old English Letter Foundries*,” pp. 185, 186.

² Mores, “*English Founders*,” p. 42.

interval many copies of the first small edition of five hundred copies have been destroyed. A perfect copy is rare, and commands a high price, for no early book on technical printing is in greater request.¹

The instruction directly given is of value, but bits of information indirectly furnished are of greater interest. From no other book can one glean so many evidences of the poverty of the old printing-house. Its scant supply of types, its shackly hand-presses, its mean printing-inks, its paper windows and awkward methods, when not specifically confessed, are plainly indicated. The high standard of proof-reading here exacted may be profitably contrasted with its sorry performance upon the following pages. The garments worn by the workmen are shown in the illustrations. Some of the quainter usages of the trade are told in the "Customs of the Chappel," and those of the masters, in the ceremonies of the Stationers' Company, and in the festivals in which masters and workmen joined. To the student of printing a reading of the book is really necessary for a clear understanding of the mechanical side of the art as practised in the seventeenth century.

¹ Hansard says ("Typographia," p. vii): "I have never been able to meet with more than two copies of this work — one in the Library of the British Museum—the other in the Library of the Society of Arts." The writer knows of but three copies in America: one in the Library Company of Philadelphia; one in the Library of the Typothetæ of New-York; one in his own collection.

NOTE BY THE PRINTER

This edition of the "Mechanick Exercises" is a line-for-line and page-for-page reprint of the original text. The only suppression is that of the repetition of the words "Volume II" in the running title and the sub-titles, which would unnecessarily mislead the reader, and of the old signature marks that would confuse the bookbinder. Typographic peculiarities have been followed, even to the copying of gross faults, like doublets, that will be readily corrected by the reader. The object of the reprint is not merely to present the thought of the author, but to illustrate the typographic style of his time with its usual defects. A few deviations from copy that seemed to be needed for a clearer understanding of the meaning of the author have been specified at the end of the second volume. The irregular spelling and punctuation of the copy, its capricious use of capitals and italics, its headings of different sizes of type, have been repeated. At this point imitation has stopped. Turned and broken letters, wrong-font characters, broken space-lines, and bent rules have not been servilely reproduced. These blemishes, as well as the frequent "monks" and "friars" in the presswork, were serious enough to prevent an attempt at a photographic facsimile of the pages.

The two copies of Moxon that have served as "copy" for this reprint show occasional differences in spelling and punctuation. Changes, possibly made in the correction of batters, or after the tardy discovery of faults, must have been done while the form was on press and partly printed. The position of the plates differs seriously in the two copies; they do not follow each other in the numerical order specified. In this reprint the plates that describe types and tools have been placed near their verbal descriptions.

The type selected for this work was cast from matrices struck with the punches (made about 1740) of the first Caslon. It is of the same large English body as that of the original, but a trifle smaller as to face, and not as compressed as the type used by Moxon; but it repeats many of his peculiarities, and fairly reproduces the more important mannerisms of the printing of the seventeenth century.

The portraits have been reproduced by the artotype process of Bierstadt; the descriptive illustrations are from the etched plates of the Hagopian Photo-Engraving Company.



Joseph Moxon.
 Born at Wakefeild August 8.

in London Anno 1627.

MECHANICK EXERCISES:

Or, the Doctrine of

Handy-works.

Applied to the Art of

Printing.

By *Joseph Moxon*, Member of the Royal Society, and *Hydrographer* to the King's Most Excellent Majesty.

L O N D O N.

Printed for *Joseph Moxon* on the West-side of *Fleet-ditch*, at the Sign of *Atlas*. 1 6 8 3.

To the Right Reverend Father in GOD,
JOHN Lord Bishop of Oxford, and
Dean of Christ-Church; And to the
Right Honourable Sir LEOLINE
JENKINS Knight, and Principal
Secretary of State; And to the Right
Honourable Sir JOSEPH WILLIAM-
SON Knight; and one of His Majesties
most Honourable Privy-Council.

Right Honourable.

Y Our ardent affections to promote
Typographie has eminently ap-
peared in the great Charge you
have been at to make it famous
here in England; whereby this Royal Island
stands particularly obliged to your Generous
and Publick Spirits, and the whole Common-
Wealth of Book-men throughout the World,
to your Candid Zeal for the promulgation of
good Learning.

Wherefore I humbly Dedicate this Piece
of Typographie to your Honours; and

as it is (I think) the first of this nature, so I hope you will favourably excuse small Faults in this Undertaking; for great ones I hope there are none, unless it be in this presumptuous Dedication; for which I humbly beg your Honours pardon: Subscribing my self, My Lord and Gentlemen,

*Your Honours most Humble
and Obedient Servant.*

Joseph Moxon.

MECHANICK

MECHANICK EXERCISES:

Or, the Doctrine of

Handy-works.

Applied to the Art of

Printing.

P R E F A C E.

B*Efore I begin with Typographie, I shall say some-what of its Original Invention; I mean here in Europe, not of theirs in China and other Eastern Countries, who (by general assent) have had it for many hundreds of years, though their Invention is very different from ours; they Cutting their Letters upon Blocks in whole Pages or Forms, as among us our Wooden Pictures are Cut; But Printing with single Letters Cast in Mettal, as with us here in Europe, is an Invention scarce above Two hundred and fifteen years old; and yet an undecidable Controversie about the original Contriver or Contrivers remains on foot,*
between

between the Harleimers of Holland, and those of Mentz in Germany: But because the difference cannot be determin'd for want of undeniable Authority, I shall only deliver both their Pleas to this Scientifick Invention.

The Harleimers plead that Lawrenz Janfz Koster of Harlem was the first Inventaer of Printing, in the year of our Lord 1430. but that in the Infancy of this Invention he used only Wooden Blocks (as in China, &c. aforesaid) but after some time he left off Wood, and Cut single Letters in Steel, which he sunck into Copper Matrices, and fitting them to Iron Molds, Cast single Letters of Mettal in those Matrices. They say also, that his Companion, John Gutenberg, stole his Tools away while he was at Church, and with them went to Mentz in Germany, and there set his Tools to work, and promoted His claim to the first Invention of this Art, before Koster did His.

To prove this, they say that Rabbi Joseph (a Jew) in his Chronicle, mentions a Printed Book that he saw in Venice, in the year 5188. according to the Jewish Account, and by ours the year 1428. as may be read in Pet. Scriverius.

They say much of a Book intituled De Spiegel, Printed at Harlem in Dutch and Latin; which Book is yet there to be seen: and they alledge that Book the first that ever was Printed: But yet say not when this Book was Printed.

Notwithstanding this Plea, I do not find (perhaps because of their imperfect Proofs) but that Gutenberg of Mentz is more generally accepted for the first Inventaer of Printing, than Koster of Harlem.

The Learned Dr. Wallis of Oxford, hath made an Inquiry into the original of this Invention, and hath in brief sum'd up the matter in these words.

About

About the year of our Lord 1460. The Art of *Printing* began to be invented and practised in *Germany*, whether first at *Mentz* or first at *Harlem* it is not agreed: But it seems that those who had it in consideration before it was brought to perfection, disagreeing among themselves, did part Company; and some of them at *Harlem*, others at *Mentz* pursued the design at the same time.

The Book which is commonly reputed to have been first Printed is, Tullies Offices, of which there be Copies extant (as a Rarity) in many Libraries; which in the close of it is said to be Printed at Mentz, in the year of our Lord 1465. (so says that Copy in the Bodleyan Library) or 1466. (so that in the Library of Corpus Christi.) The words in the close of that in Corpus Christi Colledge Oxon are these,

Præfens Marcij Tullij Clarissimum opus, Johanes Huft, Moguntinus Civis, non Atrimento, plumali canna, neq; ærea, sed Arte quadam perpulchra, Petri manu Petri de Geurshem pueri mei, feliciter effeci, finitum Anno M CCCC LX VI quarto die Mensis Februarij.

The like in the Bodleyan Library; save there the Date is only thus, Finitum Anno M CCCC LX V. In the same Book there are these written Notes subjoyned: Hic est ille Johannes Faustus, coadjutor Johannes Gutenbergij primi Typographiæ inventaris, Alter coadjuto erat Petrus Schæfer, i. Opilio. Quovix.

Cælando promptior alter erat, inquit Johan. Arnoldus in Libello de Chalcographiæ inventione, Scheffer primas finxit quas vocant Matrices. Hi tres exercuerunt artem primo in communi. mox rupto fœdere seorsim sibi quisq; privatim.

And

And again (in a later hand) Inventionem artis Typographicæ ad Annum 1453. aut exerciter referunt Sabilicus En. 10. lib. 6. & Monſterus. Alij ad Annum 1460. Vide Polid. Virg. lib. 2. de Invent. Rerum, Theod. Bibland. de Ratione communis linguarum. cap. de Chalcographia.

At Harlem and ſome other places in Holland, they pretend to have Books Printed ſomewhat ancients than this; but they are moſt of them (if not all) done by way of Carving whole Pages in Wood, not by ſingle Letters Caſt in Mettal, to be Compoſed and Diſtributed as occaſion ſerves, as is now the manner.

The chief Inventer at Harlem is ſaid to be Laurens Janſz Koſter.

*After theſe two places (Mentz and Harlem) it ſeems next of all to have been practiſed at Oxford: For by the care, and at the charge of King Henry the 6th, and of Thomas Bourchier then Arch-Biſhop of Canterbury (and Chancellour of the Univerſity of Oxford) Robert Turner Maſter of the Robe, and William Caxton a Merchant of London were for that purpoſe ſent to Harlem, at the charges partly of the King, partly of the Arch-Biſhop, who then (becauſe theſe of Harlem were very chary of this ſecret) prevailed privately with one Frederick Corſeles an under-Workman, for a ſum of Money, to come over hither; who thereupon did at Oxford ſet up the Art of Printing, before it was exerciſed any where elſe in England, or in France, Italy, Venice, Germany, or any other place, except only Mentz and Harlem (aforementioned): And there be ſeveral Copies yet extant (as one in the Archives of the Univerſity of Oxford, another in the Library of Dr. Tho. Barlow, now Biſhop of Lincoln) of a Treatiſe
of*

of St. Jerome (as it is there called (because found among St. Jerom's Works) or rather Ruffinus upon the Creed, in a broad Octavo) Printed at Oxford in the year 1468. as appears by the words in the clofe of it.

Explicit expositio Sancti Jeronimi in fembolo Apostolorum ad papam Laurentium Imprefsi Oxonie & finita Anno Domini MCCCC LXVIII. xvij die Decembris.

Which is but three years later than that of Tullies Offices at Mentz, in 1465. and was perhaps one of the first Books Printed on Paper; (that of Tully being on Vellom.) And there the excercise of Printing hath continued fucceffively to this day.

Soon after William Caxton (the fame I fuppofe who first brought it to Oxford) promoted it to London alfo, which Baker in his Chronicle (and fome others) fay to have been about the year 1471. but we have fcarce any Copies of Books there Printed remaining (that I have feen) earlier than the year 1480. And by that time, or foon after, it began to be received in Venice, Italy, Germany, and other places, as appears by Books yet extant, Printed at divers places in thofe Times. Thus far Dr. Wallis.

But whoever were the Inventers of this Art, or (as fome Authors will have it) Science; nay, Science of Sciences (fay they) certain it is, that in all its Branches it can be deemed little lefs than a Science: And I hope I fay not to much of Typographie: For Dr. Dee, in his Mathematical Preface to Euclids Elements of Geometrie, hath worthily taken pains to make Architecture a Mathematical Science; and as a vertual Proof of his own Learned Plea, quotes two Authentique Authors, viz.

Vitruvius

Vitruvius and Leo Baptista, who both give their descriptions and applause of Architecture: His Arguments are somewhat copious, and the Original easily procurable in the English Tongue; therefore instead of transcribing it, I shall refer my Reader to the Text it self.

Upon the consideration of what he has said in behalf of Architecture, I find that a Typographer ought to be equally qualified with all the Sciences that becomes an Architect, and then I think no doubt remains that Typographie is not also a Mathematical Science.

For my own part, I weighed it well in my thoughts, and find all the accomplishments, and some more of an Architect necessary in a Typographer: and though my business be not Argumentation, yet my Reader, by perusing the following discourse, may perhaps satisfy himself, that a Typographer ought to be a man of Sciences.

By a Typographer, I do not mean a Printer, as he is Vulgarly accounted, any more than Dr. Dee means a Carpenter or Mason to be an Architect: But by a Typographer, I mean such a one, who by his own Judgement, from solid reasoning with himself, can either perform, or direct others to perform from the beginning to the end, all the Handy-works and Physical Operations relating to Typographie.

*Such a Scientifick man was doubtless he who was the first Inventer of Typographie; but I think few have succeeded him in Science, though the number of Founders and Printers be grown very many: Insomuch that for the more easie managing of Typographie, the Operators have found it necessary to divide it into several Trades, each of which (in the strictest sence) stand no
nearer*

nearer related to Typographie, than Carpentry or Masonry, &c. are to Architecture. The several divisions that are made, are,

First The Master Printer, who is as the Soul of Printing; and all the Work-men as members of the Body governed by that Soul subserveient to him; for the Letter-Cutter would Cut no Letters, the Founder not sink the Matrices, or Cast and Dress the Letters, the Smith and Joyner not make the Press and other Utenfils for Printing, the Compositer not Compose the Letters, the Correcter not read Proves, the Press-man not work the Forms off at the Press, or the Inck-maker make Inck to work them with, but by Orders from the Master-Printer.

<i>Secondly, The Letter-Cutter,</i>	} Founders.
<i>Thirdly, The Letter-Caster,</i>	
<i>Fourthly, The Letter-Dresser.</i>	

But very few Founders exercise, or indeed can perform all these several Trades; though each of these are indifferently called Letter-Founders.

<i>Fifthly, The Compositer,</i>	} Printers.
<i>Sixthly, The Correcter,</i>	
<i>Seventhly, The Press-man,</i>	
<i>Eighthly, The Inck-maker.</i>	

Besides several other Trades they take in to their Assistance; as the Smith, the Joyner, &c.

ADVER-

ADVERTISEMENT.

THE continuation of my setting forth *Mechanick Exercises* having been obstructed by the breaking out of the Plot, which took off the minds of my few Customers from buying them, as formerly; And being of late much importun'd by many worthy Persons to continue them; I have promised to go on again, upon Condition, That a competent number of them may be taken off my hand by Subscribers, soon after the publication of them in the *Gazet*, or posting up Titles, or by the *Mercurius Librarius*, &c.

Therefore such Gentlemen or others as are willing to promote the coming forth of these *Exercises*, are desired to Subscribe their Names and place of abode: That so such Persons as live about this City may have them sent so soon as they come forth: Quick Sale being the best encouragement.

Some Gentlemen (to whom they are very acceptable) tell me they will take them when all *Trades* are finish't, which cannot reasonably be expected from me (my Years considered) in my life-time; which implies they will be Customers when I'me dead, or perhaps by that time some of themselves.

The price of these Books will be 2*d.* for each Printed Sheet. And 2*d.* for every Print taken off of Copper Cuts.

There are three reasons why this price cannot be thought dear.

1. The Writing is all new matter, not Collected, or Translated from any other Authors: and the drafts of the Cuts all drawn from the Tools and Machines used in each respective Trade.

2. I Print but 500 on each Sheet, And those upon good Paper: which makes the charge of Printing dear, proportionable to great numbers.

3. Some Trades are particularly affected by some Customers, (who desire not the rest,) and consequently sooner fold off, which renders the remainder of the un-fold *Exercises* unperfect, and therefore not acceptable to such as desire all: so that they will remain as waste-Paper on my hands.

JOSEPH MOXON.

MECHANICK EXERCISES:

Or, the Doctrine of

Handy-works.

Applied to the Art of

Printing.

§ 2. *Of the Office of a Master-Printer.*

I Shall begin with the Office of a *Master-Printer*, because (as aforefaid) he is the Director of all the Work men, he is the Base (as the *Dutchmen* properly call him) on which the Workmen stand, both for providing Materials to Work withal, and fucceffive variety of Directions how and in what manner and order to perform that Work.

His Office is therefore to provide a House, or Room or Rooms in which he is to set his *Printing-House*. This expreffion may seem strange, but it is *Printers Language*: For a *Printing-House* may admit of a twofold meaning; one the Vulgar acceptance, and

and is relative to the House or Place wherein *Printing* is used; the other a more peculiar Phrase *Printers* use among themselves, *viz.* only the *Printing Tools*, which they frequently call a *Printing-House*: Thus they say, Such a One has set up a *Printing-House*, when as thereby they mean he has furnish'd a House with *Printing Tools*. Or such a one has remov'd his *Printing-House*, when thereby they only mean he has remov'd the Tools us'd in his former House. These expressions have been used Time out of mind, and are continued by them to this day.

But to proceed, Having consider'd what number of *Presses* and *Cases* he shall use, he makes it his business to furnish himself with a Room or Rooms well-lighted, and of convenient capacity for his number of *Presses* and *Cases*, allowing for each *Press* about Seven Foot square upon the Floor, and for every *Frame* of *Cases* which holds Two pair of *Cases*, *viz.* one pair *Romain* and one pair *Itallica*, Five Foot and an half in length (for so much they contain) and Four Foot and an half in breadth, though they contain but Two Foot and Nine Inches: But then room will be left to pass freely between two *Frames*.

We will suppose he resolves to have his *Presses* and *Cases* stand in the same Room (though in *England* it is not very customary) He places the *Cases* on that side the Room where they will most conveniently stand, so, as when the *Compositer* is at work the Light may come in on his Left-hand; for else his Right-hand plying between the Window-light and his Eye might shadow the *Letter* he would pick up: And the *Presses* he places so, as the Light may fall from a Window
right

right before the *Form* and *Tinpan*: And if scituation will allow it, on the North-side the Room, that the *Press-men*, when at their hard labour in *Summer* time, may be the less uncommoded with the heat of the *Sun*: And also that they may the better see by the constancy of that Light, to keep the whole *Heap* of an equal Colour.

He is also to take care that his *Presses* have a solid and firm Foundation, and an even Horizontal Floor to stand on, That when the *Presses* are set up their Feet shall need no Underlays, which both damage a *Press*, are often apt to work out, and consequently subject it to an unstable and loose position, as shall further be shewn when we come to the Setting up of the *Press*.

And as the Foundation ought to be very firm, so ought also the Roof and Sides of the *Press Room* to be, that the *Press* may be fastned with Braces overhead and on its Sides, as well and steddly as under foot.

He is also to take care that the Room have a clear, free and pretty lofty Light, not impeded with the shadow of other Houses, or with Trees; nor so low that the Sky-light will not reach into every part of the Room: But yet not too high, lest the violence of *Winter* (*Printers* using generally but Paper-windows) gain too great advantage of Freezing the Paper and Letter, and so both Work and Workman stand still. Therefore he ought to Philosophize with himself, for the making the height of his Lights to bear a rational proportion to the capacity of the Room.

Here being but two sides of the Room yet used,
he

he places the *Correcting stone* against a good Light, and as near as he can towards the middle of the Room, that the *Compositors* belonging to each end of the Room may enjoy an equal access to it. But sometimes there are several *Correcting-stones* plac'd in several parts of the Room.

The *Lye-Trough* and *Rincing-Trough* he places towards some corner of the Room, yet so as they may have a good Light; and under these he causes a *Sink* to be made to convey the Water out of the Room: But if he have other conveniencies for the placing these Troughs, he will rather set them out of the Room to avoid the flabbering they cause in.

About the middle of the Room he places the *Distributing-Frame* (*viz.* the *Frame* on which the *Forms* are set that are to be *Distributed*) which may stand light enough, though it stand at some considerable distance from the Window.

In some other empty place of the Room (least frequented) he causes so many *Nest-Frames* to be made as he thinks convenient to hold the *Cases* that may lye out of present use; and the *Letter-boards* with *Forms* set by on them, that both the *Cases* and the *Forms* may be the better secured from running to *Pye*.

Having thus contrived the several Offices of the Room, He furnishes it with *Letters*, *Presses*, *Cases*, *Chases*, *Furniture*, &c. Of each of which in Order.

¶. 2. *Of Letter.*

He provides a *Fount* (properly a *Fund*) of *Letter* of all *Bodies*; for most *Printing-Houses* have all except the two first, viz. *Pearl*, *Nomparel*, *Brevier*, *Long-Primmer*, *Pica*, *English*, *Great-Primmer*, *Double-Pica*, *Two-Lin'd-English*, *Great-Cannon*.

These are the *Bodies* most of use in *England*; But the *Dutch* have several other *Bodies*: which because there is little and almost no perceivable difference from some of these mentioned, I think they are not worth naming. Yet we have one *Body* more which is sometimes used in *England*; that is a *Small Pica*, but I account it no great discretion in a *Master-Printer* to provide it; because it differs so little from the *Pica*, that unless the Workmen be carefuller than they sometimes are, it may be mingled with the *Pica*, and so the Beauty of both *Founts* may be spoil'd.

These aforesaid *Bodies* are commonly *Cast* with a *Romain*, *Italica*, and sometimes an *English Face*. He also provides some *Bodies* with the *Musick*, the *Greek*, the *Hebrew*, and the *Syriack Face*: But these, or some of these, as he reckons his opportunities may be to use them.

And that the Reader may the better understand the sizes of these several *Bodies*, I shall give him this Table following; wherein is set down the number of each *Body* that is contained in one Foot.

Pearl,

<i>Pearl,</i>	184	} contained in one Foot.
<i>Nomparel,</i>	150	
<i>Brevier,</i>	112	
<i>Long-Primmer,</i>	92	
<i>Pica,</i>	75	
<i>English,</i>	66	
<i>Great-Primmer,</i>	50	
<i>Double-Pica,</i>	38	
<i>Two Lin'd English,</i>	33	
<i>Great-Cannon.</i>	17½	

His care in the choice of these *Letters* are,
First, That the *Letter* have a true shape: Which
he may know, as by the §. of *Letter-Cutting*.

I confess this piece of Judgement, *viz.* knowing
of true Shape, may admit of some controversy, be-
cause neither the Ancients whom we received the
knowledge of these *Letters* from, nor any other au-
thentick Authority have delivered us Rules, either to
make or know true shape by: And therefore it may
be objected that every one that makes *Letters* but
tolerably like *Romain*, *Italick*, &c. may pretend his
to be true shap'd.

To this I answer, that though we can plead no
Ancient Authority for the shape of *Letters*, yet
doubtless (if we judge rationally) we must conclude
that the *Romain Letters* were Originally invented and
contrived to be made and consist of Circles, Arches
of Circles, and straight Lines; and therefore those
Letters that have these Figures, either entire, or else
properly mixt, so as the Course and Progress of the
Pen

Pen may best admit, may deserve the name of true Shape, rather than those that have not.

Besides, Since the late made *Dutch-Letters* are so generally, and indeed most deservedly accounted the best, as for their Shape, consisting so exactly of Mathematical Regular Figures as aforesaid, And for the commodious Fatness they have beyond other *Letters*, which easing the Eyes in Reading, renders them more Legible; As also the true placing their Fats and their Leans, with the sweet driving them into one another, and indeed all the accomplishments that can render *Letter* regular and beautiful, do more visibly appear in them than in any *Letters* Cut by any other People: And therefore I think we may account the Rules they were made by, to be the Rules of true shap'd *Letters*.

For my own part, I liked their *Letters* so well, especially those that were Cut by *Christophel Van Dijck* of *Amsterdam*, that I set my self to examine the Proportions of all and every the parts and Members of every *Letter*, and was so well pleased with the Harmony and Decorum of their Symetrie, and found so much Regularity in every part, and so good reason for his Order and Method, that I examined the biggest of his *Letters* with Glasses, which so magnified the whole *Letter*, that I could easily distinguish, and with small Dividers measure off the size, situation and form of every part, and the proportion every part bore to the whole; and for my own future satisfaction collected my Observations into a Book, which I have inserted in my *Exercises* on *Letter-Cutting*. For therein I have exhibited to
the

the World the true Shape of *Christophel Van Dijcks* aforefaid *Letters*, largely Engraven in Copper Plates.

Whence I conclude, That ſince common conſent of Book-men aſſign the Garland to the *Dutch-Letters* as of late *Cut*, and that now thoſe *Letters* are reduced unto a Rule, I think the Objection is Answered; And our *Maſter-Printers* care in the choice of good and true ſhap'd *Letters* is no difficult Task: For if it be a large Bodied *Letter*, as *English*, *Great-Primmer* and upwards, it will ſhew it ſelf; and if it be ſmall, as *Pearl*, *Nomparel*, &c. though it may be difficult to judge the exact Symetry with the naked Eye, yet by the help of a *Magnifying-Glaſs* or two if occaſion be, even thoſe ſmall *Letters* will appear as large as the biggeſt Bodied *Letters* ſhall to the naked Eye: And then it will be no difficult Task to judge of the Order and Decorum even of the ſmalleſt Bodied *Letters*. For indeed, to my wonder and aſtoniſhment, I have obſerv'd *V. Dijcks Pearl Dutch Letters* in Glaſſes that have Magnified them to great *Letters*, and found the whole Shape bear ſuch true proportion to his great *Letters*, both for the *Thickneſs*, *Shape*, *Fats* and *Leans*, as if with Compaſſes he could have meaſur'd and ſet off in that ſmall compaſs every particular Member, and the true breadth of every *Fat* and *Lean Stroak* in each *Letter*, not to exceed or want (when magnified) of *Letter Cut* to the *Body* it was Magnified to.

His ſecond care in the choice of *Letters* is, That they be deep *Cut*; for then they will *Print* clear the longer, and be leſs ſubject to entertain *Picks*.

His third care, That they be deep ſunk in the
Matrices,

Matrices leaft the bottom line of a *Page* Beard. Yet though they be deep funk, His care ought to be to fee the Beard alfo well cut off by the *Founder*.

And a Fourth Care in the choice of *Letter* is, That his *Letter* be Caft upon good Mettal, that it may laft the longer.

Of each Body he provides a *Fount* fuitable to fuch forts of Work as he defigns to do; But he provides not an equal weight of every *Fount*; Because all thefe Bodies are not in equal ufe: For the *Long-Primmer*, *Pica* and *English* are the Bodies that are generally moft ufed; And therefore he provides very large *Founts* of thefe, *viz.* of the *Long-Primmer* in a fmall *Printing-Houfe*, Five hundred Pounds weight *Romain* and *Italica*, whereof One hundred and fifty Pounds may be *Italica*. Of the *Pica* and *English*, *Roman* and *Italica*, Eight, Nine hundred, or a Thoufand Pounds weight: when as of other *Founts* Three or Four hundred Pounds weight is accounted a good *Fount*: And of the *Canon* and *Great-Canon*, One hundred Pounds or fomewhat lefs may ferve his turn; Because the common ufe of them is to fet Titles with.

Befides *Letters* he Provides Characters of Aftronomical Signs, *Planets*, *Aspects*, *Algebraical* Characters, Phyfical and Chimal Characters, &c. And thefe of feveral of the moft ufed Bodies.

He Provides alfo *Flowers* to fet over the Head of a *Page* at the beginning of a Book: But they are now accounted old-fashion, and therefore much out of ufe. Yet *Wooden-Borders*, if well Drawn, and neatly Cut, may be *Printed* in a Creditable Book, As alfo,

Wooden-

Wooden-Letters well Drawn and neatly Cut may be used at the beginning of a *Dedication, Preface, Section, &c.* Yet instead of *Wooden Letters, Capitals* Cast in Mettal generally now serves; because but few or good *Cutters* in *Wood* appear.

He also provides *Brafs Rules* of about Sixteen Inches long, that the *Compositer* may cut them into such Lengths as his Work requires.

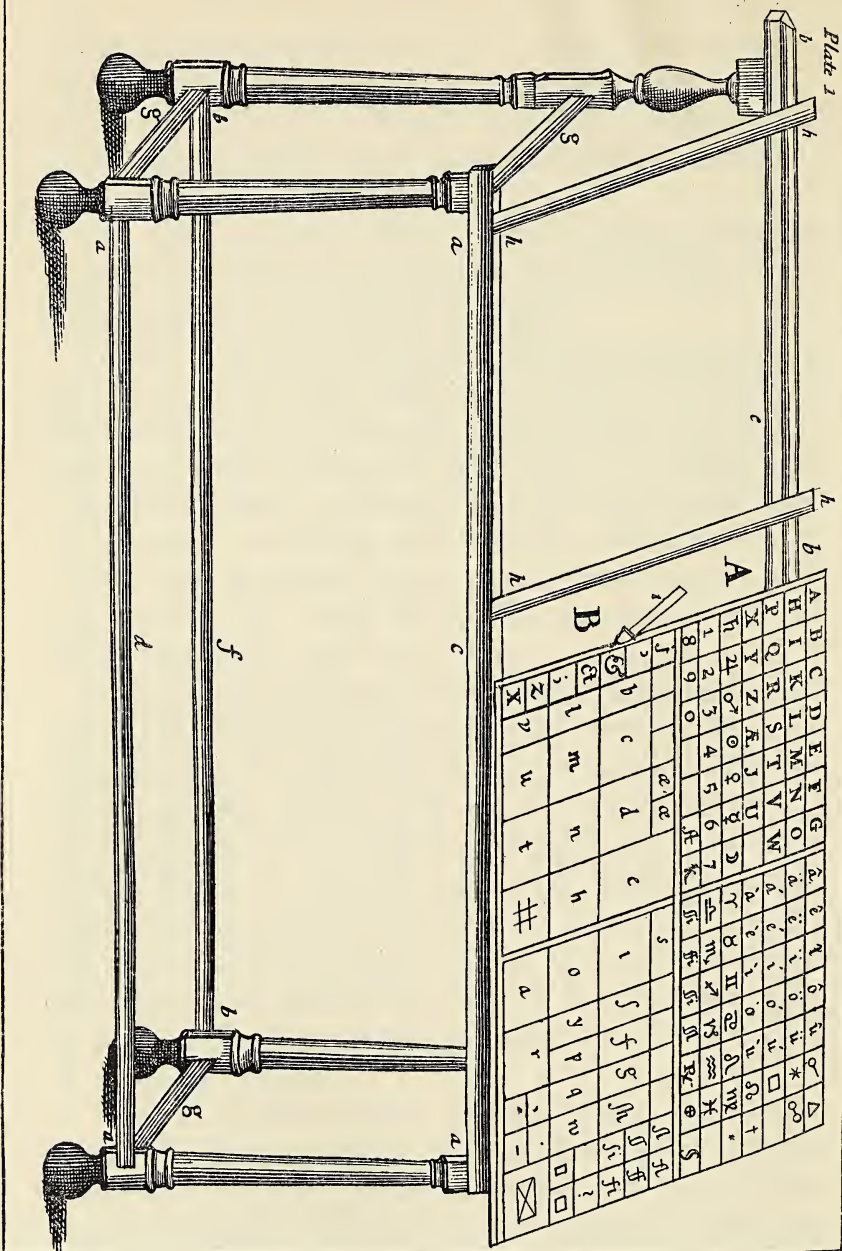
In the choice of his *Brafs Rules*, he examines that they be exactly *Letter* high; for if they be much too high, they may cut through *Paper, Tinpan* and *Blankets* too; And if they be but a little too high, not only the Sholder, or Beard, on either side them will *Print* black; but they will bear the *Plattin* off the *Letters* that stand near them, so that those *Letters* will not *Print* at all: And if they be too low, then the *Rules* themselves will not *Print*.

It sometimes happens through the unskilfulness of the *Joyner*, (for they commonly, but improperly, employ *Joyners* to make them) that a Length shall be hollow in the middle both on the Face and Foot, and shall run driving higher and higher towards both ends: Hence it comes to pass, that when the *Compositer* cuts a piece of *Rule* to his intended Length, the *Rule* shall *Print* hard at one end, and the other shall not *Print* at all; So that he shall be forced to knock up the foot of the low end, as shall be shewn in its proper place.

But the careful *Master-Printer* having found that his *Brafs Rules* is *Letter* high all the whole Length, will also examine whether it be straight all the whole Length, which he does by applying both the

Face

Plate 1



Face and Foot to the surface of the *Correcting-stone*; And if the Face and Foot comply so closely with the *Correcting-stone*, that light cannot be seen between them, he concludes the *Brass-Rule* is straight.

Then he examines the Face or Edge of the *Rule*, whether it have an Edge of an equal breadth all the whole Length, and that the Edge be neither too thick nor too fine for his purpose.

He should also take care that the *Brass*, before it be cut out, be well and skilfully Planish't, nor would that charge be ill bestow'd; for it would be saved out of the thickness of the *Brass* that is commonly used: For the *Joyners* being unskilful in Planishing, buy Neal'd thick *Brass* that the *Rule* may be strong enough, and so cut it into slips without Hammering, which makes the *Rule* easily bow any way and stand so, and will never come to so good and smooth an Edge as Planish't *Brass* will. Besides, *Brass* well Planish't will be stiffer and stronger at half the thickness than unplanish't *Brass* will at the whole: As I shall further shew when I come to Exercise upon *Mathematical Instrument-making*.

§. 3. Of Cases.

Next he provides *Cases*. A Pair of *Cases* is an *Upper-Case* and a *Lower Case*.

The *Upper Case* and the *Lower-Case* are of an equal length, breadth and depth, viz. Two Foot nine Inches long, One Foot four Inches and an half broad, and about an Inch and a quarter deep, besides the bottom Board; But for small Bodied *Letters* they are made somewhat shallower, and for great Bodies deeper.

Long-

Long-Primmer and downwards are accounted fmall Bodies; *English* and upwards are accounted great Bodies.

The conveniencies of a fhallow *Cafe* is, that the *Letters* in each Box lye more vifible to the laft, as being lefs fhadowed by the fides of the *Boxes*.

The conveniencies of a deep *Cafe* is, that it will hold a great many *Letters*, fo that a *Compoſiter* needs not fo often *Deſtribute*. 2dly. It is not fo ſoon *Low*, (as *Compoſiters* ſay when the *Cafe* grows towards empty) and a *Low Cafe* is inconvenient for a *Compoſiter* to work at, partly becauſe the *Cafe* ſtanding ſhelves downwards towards them, the *Letters* that are in the *Cafe* tend towards the hither ſide of the *Cafe*, and are ſhadowed by the hither ſide of that *Box* they lye in, ſo that they are not ſo eaſily ſeen by the Eye, or ſo ready to come at with the Fingers, as if they lay in the middle of the *Box*.

Theſe *Cafes* are encompassed about with a *Frame* about Three quarters of an Inch broad, that the ends of the ſeveral partitions may be let into the ſubſtance of the *Frame*: But the hithermoſt ſide of the *Frame* is about half an Inch higher than the other ſides, that when either the *Galley* or another pair of *Cafes* are ſet upon them, the bottom edge of the *Galley*, or of thoſe *Cafes* may ſtop againſt that higher *Frame*, and not ſlide off.

Both the *Upper* and the *Lower Cafe* have a thick Partition about three quarters of an Inch broad, Duff-tail'd into the middle of the upper and under Rail of the *Frame*. This Partition is made thus broad, that Grooves may be made on either ſide of it to receive

ceive the ends of those Partitions that divide the breadth of the *Cafe*, and also to strengthen the whole *Frame*; for the bottom Board is as well nailed to this thick Partition as to the outer *Frame* of the *Cafe*.

But the divisions for the several *Boxes* of the *Upper* and *Lower Cafes* are not alike: for each half of the whole length of the *Upper-Cafe* is divided into seven equal parts, as you may see in Plate 1. at A, and its breadth into seven equal parts, so that the whole *Upper-Cafe* is divided into Ninety eight square *Boxes*, whose sides are all equal to one another.

But the Two halves of the length of the *Lower-Cafe* are not thus divided; for each half of the length of the *Lower-Cafe* is divided into Eight equal parts, and its breadth into Seven; but it is not throughout thus divided neither; for then the *Boxes* would be all of equal size: But the *Lower-Cafe* is divided into four several sizes of *Boxes*, as you may see in Plate 1. B.

The reason of these different sizes of *Boxes* is, That the biggest *Boxes* may be disposed nearest the *Compositors* hand, because the English Language, and consequently all English *Coppy* runs most upon such and such Sorts; so that the *Boxes* that holds those Sorts ought to be most capacious.

His care in the choice of these *Cafes* is, That the Wood they are made of be well-season'd Stuff.

That the Partitions be strong, and true let into one another, and that the ends fill up and stand firm in the Grooves of the *Frame* and middle *Rail* of the *Cafe*.

There is an inconvenience that often happens, these thin Partitions, especially if they be made of unseason'd Stuff, *viz.* as the Stuff dries it shrinks in the Grooves

Grooves of the *Frame*, and fo not only grows loofe, but fometimes ftarts out above the top of the *Frame*. To prevent this inconvenience, I have of late caufed the ends of thefe thin partitions to be made Male-Duf-tails, broadeft on the under fide, and have them fitted into Female-Duf-tails in the *Frame* of the *Cafe*, and middle Rail before the bottom Boards are nailed on.

That the Partitions be full an *Engliſh* Body thick.

That the Partitions lye clofe to the bottom of the *Cafe*, that fo the *Letters* flide not through an upper into an under *Box*, when the Papers of the *Boxes* may be worn.

 . 4. Of Frames to fet the Cafes on.

Frames are in moſt *Printing-Houſes* made of thick *Deal-board Battens*, having their feveral *Rails Tennanted* into the *Stiles*: but thefe forts of *Frames* are, in reſpect of their matter (*viz.* *Fir*) fo weak, and in reſpect of their ſubſtance (*viz.* little above an Inch thick) fo flight, that experience teaches us, when they are even new made, they tremble and totter, and having laſted a little while, the thinneſs of their *Tennants* being a little above a quarter of an Inch thick, according to the Rules of *Joyner*y, as I have ſhewn in *Numb.* 5.  . 17. They Craze, their *Tennants* break, or *Morteffes* ſplit, and put the *Maſter-Printer* to a freſh Charge.

It is rationally to be imagined that the *Frames* ſhould be deſigned to laſt as long as the *Printing houſe*; and therefore our *Maſter-Printer* ought to take care that they be made of matter ſtrong enough, and of ſubſtance big enough to do the Service they are intended for;

for; that they stand substantial and firm in their place, so as a small Jostle against them shake them not, which often reiterated weakens the *Frame-work*, and at that present is subject to shake the *Letter* in the *Galley* down.

I shall not offer to impose Rules upon any here, especially since I have no Authority from Prescript or Custom; yet I shall set down the Scantlings that I my self thought fit to use on this occasion. A Delineation of the *Frames* are in Plate 1. at C.

a a a a The *Fore-Rails*.

b b b b The *Hind-Rails*.

c The *Top Fore-Rail*.

d The *Bottom-Fore-Rail*.

e The *Top Hind-Rail*.

f The *Bottom Hind-Rail*.

g g g g The *End-Rail*.

h h h h *Cross-Bearers*.

I made the *Rails* and *Stiles* of well-seasoned fine *Oak*, clean, (that is free from Knots and Shakes) the *Stiles* and *Rails* two Inches and an half square, the *Top* and *Bottom Fore-Rails* and the *Bottom Hind-Rail* four Foot three Inches long, besides their *Tenants*; And the *Top Hind Rail* five Foot three Inches long. The two *Fore-Rails* and *Bottom Hind-Rail* had Iron Female Screws let into them, which, through an hole made in the *Stiles*, received a Male-Screw with a long shank, and a Sholder at the end of it to screw them tight and firm together, even as the *Rails* of a *Bedsted* are screwed into the *Mortesses* of a *Bed-Post*. Each

Each *Back Stile* was four Foot one Inch and an half high befides their *Tennants*, and each *Fore-Stile* three Foot three Inches high, each *Fore* and *Back-Stile* had two *Rails* one Foot feven Inches long, befides their *Tennants* Tennanted and Pin'd into them, becaufe not intended to be taken affunder.

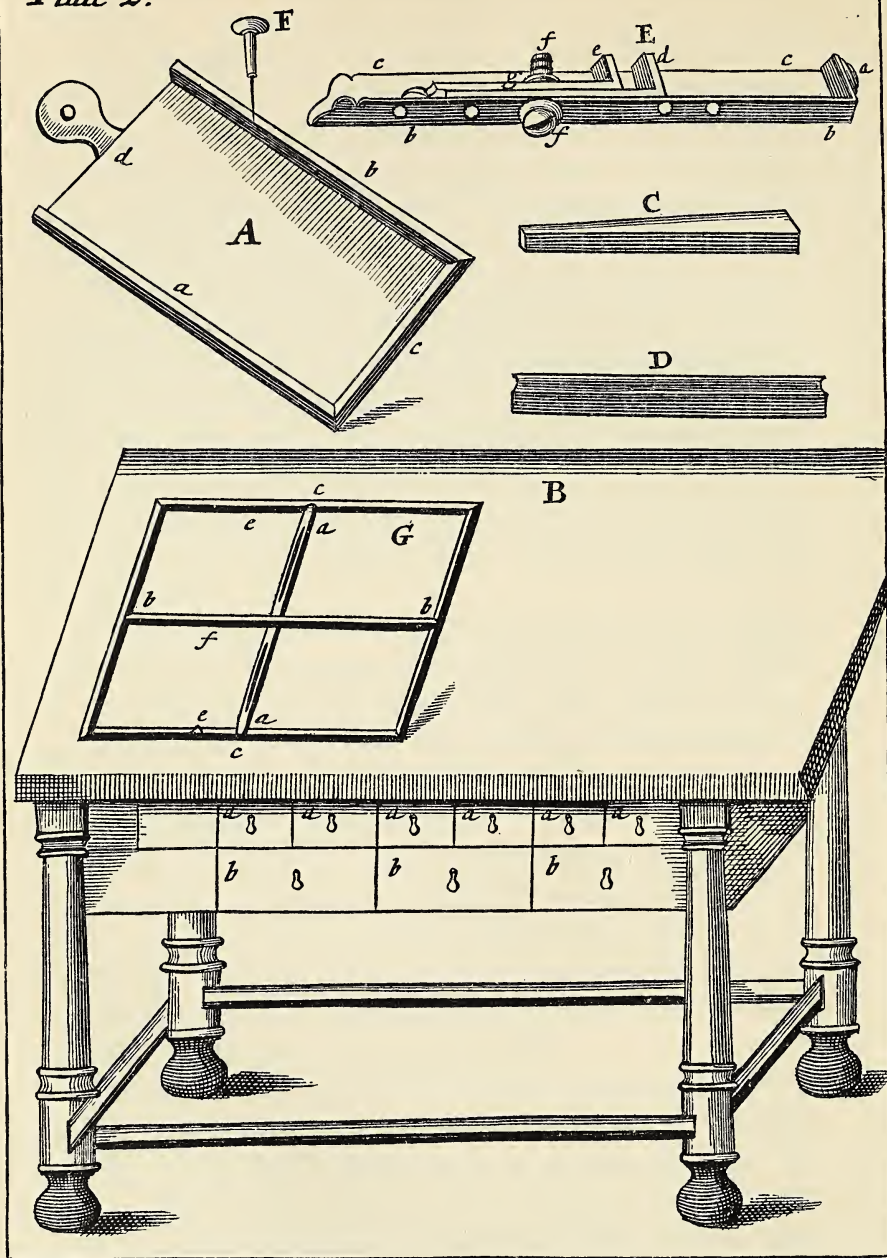
It muft be confidered, that the *Fore ftiles* be of a convenient height for the pitch of an ordinary Man to ftand and work at, which the heighth aforefaid is; And that the *Hind ftiles* be fo much higher than the *Fore-ftiles*, that when the *Crofs-Bearers* are laid upon the upper *Fore* and *Hind-Rail*, and the *Cafes* laid on them, the *Cafes* may have a convenient declivity from the upper fide the *Upper-Cafe*, to the lower fide the *Lower-Cafe*.

The Reason of this declivity is, becaufe the *Cafes* ftanding thus before the Workman, the farther *Boxes* of the *Upper-Cafe* are more ready and eafie to come at, than if they lay flat; they being in this pofition fomewhat nearer the hand, and the *Letters* in thofe *Boxes* fomewhat eafier feen.

If the Workman prove taller than Ordinary, he lays another or two pair of *Cafes* under the *Cafes* he uſes, to mount them: If the Workman be ſhort, as Lads, &c. He lays a *Paper-board* (or ſometimes two) on the floor by the Fore-fide of the *Frame*, and ftanding to work on it, mounts himſelf.

The *Bearers* are made of *Slit-Deal*, about two Inches broad, and ſo long as to reach from the *Fore-Rail* through the *Upper-Rail*, and are let in, ſo as to lye even with the ſuperficies of the *Fore* and *Hind-Rail*, and at ſuch a diſtance on both the *Rails*, as you may ſee in the Figure. On

Plate 2.



On the Superficies of the *Fore-Rail*, even with its Fore-Edge is nailed a small *Riglet* about half an Inch high, and a quarter and half quarter of an Inch thick, that the *Cases* set on the *Frame* having the aforefaid declivity, may by it be stop't from fliding off.

§. 5. *Of the Galley.*

Our *Master-Printer* is alfo to provide *Galleys* of different fizes, That the *Compositer* may be fuited with fmall ones when he *Composes* fmall *Pages*, and with great ones for great *Pages*.

The *Galley* is marked A in Plate 2.

a b c The Sides or Frame of the *Galley*.

d The *Slice*.

Thefe *Galleys* are commonly made of two flat *Wainfcot Boards*, each about a quarter and half quarter of an Inch thick, the uppermoft to flide in Grooves of the *Frame*, clofe down to the undermoft, though for fmall *Pages* a fingle Board with two fides for the *Frame* may ferve well enough: Thofe *Wainfcot Boards* are an Oblong Square, having its length longer than its breadth, even as the form of a *Page* hath. The three Sides of the *Frame* are fixed faft and fquare down on the upper Plain of the undermoft Board, to ftand about three fifth parts of the height of the *Letter* above the fuperficies of the *Slice*. The Sides of the *Frame* muft be broad enough to admit of a pretty many good ftrong *Oaken Pins* along the

the Sides, to be drove hard into the Bottom Board, and almost quite through the Sides of the Frame, that the Frame may be firmly fixed to it: But by no means must they be Glewed on to the Bottom Board, because the *Compositer* may sometimes have occasion to wet the *Page* in the *Galley*, and then (the *Galley* standing aslope upon the *Casse*) the Water will soak between the sides of the Frame, and under Board, and quickly loosen it.

§. 6. Of the Correcting-stone.

The *Correcting-Stone* marked B in Plate 2. is made of *Marble*, *Purbeck*, or any other Stone that may be made flat and smooth: But yet the harder the Stone is the better; wherefore *Marble* is more preferable than *Purbeck*. First, Because it is a more compact Stone, having fewer and smaller Pores in it than *Purbeck*. And Secondly, because it is harder, and therefore less subject to be prick'd with the corners of a *Chase*, if through carelessness (as it sometimes happens) it be pitch'd on the Face of the Stone.

It is necessary to have it capacious, *viz.* large enough to hold two *Chases* and more, that the *Compositer* may sometimes for his convenience, set some *Pages* by on it ready to *Impose*, though two *Chases* lye on the *Stone*: Therefore a *Stone* of about Four Foot and an half long, and Two Foot broad is a convenient size for the generality of Work.

This *Stone* is to be laid upon a strong *Oaken*-wood Frame, made like the Frame of a common Table, so high, that the Face of the *Stone* may lye about three
Foot

Foot and an Inch above the Floor: And under the upper Rail of the Frame may be fitted a Row or two of Draw-Boxes, as at *a a a a a a* and *b b b* on each of its longest Sides to hold *Flowers, Brags-Rules, Braces, Quotations, small Scabbords, &c.*

§. 7. *Of Letter-Boards, and Paper-Boards.*

Letter-Boards are Oblong Squares, about two Foot long, eighteen Inches broad, and an Inch and a quarter thick. They ought to be made of clean and well-season'd Stuff, and all of one piece: Their upper-side is to be Plained very flat and smooth, and their under-side is Clamped with pieces about two Inches square, and within about four Inches of either end, as well to keep them from Warping, as to bear them off the Ground or any other Flat they stand on, that the Fingers of the *Compositer* may come at the bottom of the Board to remove it whither he will: They are commonly made of *Fir*, though not so thick as I have mentioned, or all of one Piece: *Deal-Boards* of this breadth may serve to make them of; but *Joyners* commonly put *Master-Printers* off with ordinary *Deal-Boards*, which not being broad enough, they joyn two together; for which cause they frequently shrink, so as the joynt comes assunder, and the *Board* becomes useles, unless it be to serve for a *Paper-Board* afterwards: For small and thin *Letters* will, when the Form is open, drop through, so as the *Compositer* cannot use the Board.

I us'd to make them of *Sugar-Chest*; That Stuff being commonly well-season'd, by the long lying of the
Sugar

Sugar in it, and is besides a fine hard Wood, and therefore less subje&t to be injured by the end of the *Shooting-Stick* when a *Form* is *Unlocking*.

Paper-Boards are made just like the *Letter-Boards*, though seldom so large, unless for great Work: Nor need such strict care be taken in making them so exactly smooth: their Office being only to set *Heaps of Paper* on, and to *Press* the *Paper* with.

§. 8. Of Furniture, Quoyns, Scabbord, &c.

By *Furniture* is meant the *Head-sticks*, *Foot-sticks*, *Side-sticks*, *Gutter-sticks*, *Riglets*, *Scabbords* and *Quoyns*.

Head sticks and all other *Furniture*, except *Scabbord*, are made of dry *Wainscot*, that they may not shrink when the *Form* stands by; They are *Quadrat* high, straight, and of an equal thickness all the length: They are made of several thicknesses for several Works, viz. from a *Brevier* which serves for some *Quarto's* to six or eight *Pica* thick, which is many times us'd to *Folio's*: And many of the *Head-sticks* may also serve to make Inner *Side-sticks* of; for the *MasterPrinter* provides them of lengths long enough for the *Compositer* to cut to convenient Scantlins or Lengths, they being commonly about a Yard long when they come from the *Joyners*. And *Note*, that the *Head* and *Side-sticks* are called *Riglets*, if they exceed not an *English* thick.

Outer *Side-sticks* and *Foot-sticks* marked C in Plate 2. are of the same height of the *Head-sticks*, viz. *Quadrat* high, and are by the *Joyner* cut to the given length, and to the breadth of the particular *Pages* that

that are to be *Imposed*: The *Side-sticks* are placed against the outer side of the *Page*, and the *Foot-sticks* against the foot or bottom of the *Page*: The outer sides of these *Side* and *Foot-sticks* are bevil'd or sloped from the further to the hither end.

Gutter-sticks marked D in Plate 2. are as the former, *Quadrat* high, and are used to set between *Pages* on either side the *Crosses*, as in *Octavo's*, *Twelves*, *Sixteens*, and *Forms* upwards; They are made of an equal thickness their whole length, like *Head-sticks*; but they have a Groove, or Gutter laid on the upper side of them, as well that the Water may drain away when the *Form* is Washed or Rinced, as that they should not *Print*, when through the tenderness of the *Tinpan*, the *Plattin* presses it and the *Paper* lower than ordinary.

Scabbord is that sort of *Scale* commonly fold by some *Iron-mongers* in Bundles; And of which, the *Scabbords* for *Swords* are made: The *Compositer* cuts it *Quadrat* high, and to his Length.

The *Master-Printer* is to provide both *Thick* and *Thin Scabbord*, that the *Compositer* may use either when different Bodied *Letter* happens in a *Page*, to justify the *Page* to a true length; And also that the *Pressman* may chuse *Thick* or *Thin* to make truer *Register*, as shall be shewed in proper place.

Quoyns are also *Quadrat* high, and have one of their sides Bevil'd away to comply with the Bevil of the *Side* and *Foot-sticks*; they are of different Lengths, and different Breadths: The great *Quoyns* about three Inches square, except the Bevil on one side as aforefaid; and these sizes deminish downwards
to

to an Inch and an half in length, and half an Inch in breadth.

Of these *Quoyns* our *Master-Printer* provides several hundreds, and should provide them of at the least ten different Breadths between the aforefaid sizes, that the *Compositer* may chuse such as will best fit the *Chase* and *Furniture*.

The Office of these *Quoyns* are to *Lock* up the *Form*, viz. to wedge it up (by force of a *Mallet* and *Shooting-stick*) so close together, both on the sides and between Head and Foot of the *Page*, that every *Letter* bearing hard against every next *Letter*, the whole *Form* may *Rise*; as shall be shewed hereafter.

Their farther Office is to make *Register* at the *Prefs*.

§. 9. ¶. 1. *Of the Mallet, Shooting-stick and Dressing-Block, Composing-sticks, Bodkin, and Chase. &c.*

Printers Mallets have a *Cilindricks* Head, and a round Handle; The Head somewhat bigger, and the Handle somewhat longer than those *Joyners* commonly use; Yet neither shape or size different for any reason to be given: But only a Custom always used to have them so. The Head is commonly made of *Beech*.

¶. 2. *Of*

¶. 2. *Of the Shooting-stick.*

The *Shooting-stick* must be made of *Box*, which Wood being very hard, and withal tough, will best and longest endure the knocking against the *Quoyns*. Its shape is a perfect Wedge about six Inches long, and its thicker end two Inches broad, and an Inch and an half thick; and its thin end about an Inch and an half broad, and half an Inch thick.

¶. 3. *Of the Dressing-Block.*

The *Dressing-Block* should be made of *Pear-tree*, Because it is a soft wood, and therefore less subject to injure the Face of the *Letter*; it is commonly about three Inches square, and an Inch high. Its Office is to run over the Face of the *Form*, and whilst it is thus running over, to be gently knock't upon with the Head of the *Shooting stick*, that such *Letters* as may chance to stand up higher than the rest may be pressed down.

Our *Master-Printer* must also provide a pair of *Sheers*, such as *Tailors* use, for the cutting of *Brass-Rules*, *Scabbords*, &c.

A large *Spunge* or two, or more, he must also provide, one for the *Compositers* use, and for every *Press* one.

Pretty fine *Packthread* to tie up *Pages* with; But this is often chosen (or at least directed) by the *Compositor*, either finer or courser, according to the great or small *Letter* he works upon.

¶. 4. *Of*

¶. 4. *Of the Composing-stick.*

Though every *Compositer* by Custom is to provide himself a *Composing-stick*, yet our *Master-Printer* ought to furnish his House with these Tools also, and such a number of them as is suitable to the size of his House; Because we will suppose our *Master-Printer* intends to keep some Apprentices, and they, unless by contract or courtesie, are not used to provide themselves *Composing-sticks*: And besides, when several *Compositers* work upon the same Book, their Measures are all set alike, and their *Titles* by reason of *Notes* or *Quotations* broader than their common Measure, So that a *Composing-stick* is kept on purpose for the *Titles*, which must therefore be common to all the *Compositers* that work upon that Work; And no one of them is obliged to provide a *Composing-stick* in common for them all: Therefore it becomes our *Master-Printers* task to provide them.

It is delineated in Plate 2. at *E*.

a The *Head*.

b b The *Bottom*.

c c The *Back*.

d The lower *Sliding-Measure*, or *Cheek*.

e The upper *Sliding-Measure*, or *Cheek*.

f f The *Male-Screw*.

g The *Female-Screw*.

These *Composing-sticks* are made of Iron Plate about the thickness of a thin *Scabbord*, and about ten
Inches

Inches long doubled up square; so as the Bottom may be half an Inch and half a quarter broad, and the Back about an whole Inch broad. On the further end of this Iron Plate thus doubled up, as at *a* is Soldered on an Iron Head about a *Long-Primmer* thick; But hath all its outer edges Bafil'd and Fil'd away into a Molding: This Iron Head must be so let into the Plate, and Soldered on to it, that it may stand truly square with the bottom, and also truly square with the Back, which may be known by applying the outer sides of a square to the Back and Bottom; as I shewed, *Numb. 3. Fol. 38, 39.* About two Inches from the Head, in the Bottom, is begun a row of round holes about an Inch asunder, to receive the shank of the *Male-Screw* that screws the *Sliding Measures* fast down to the Bottom; so that the *Sliding-Measures* may be set nearer or further from the Head, as the Measure of a *Page* may require.

The lower *Sliding-Measure* marked *d* is an Iron Plate a *thick Scabbord* thick, and of the Breadth of the inside of the Bottom; It is about four Inches long, and in its middle hath a Groove through it within half an Inch of the Fore-end, and three quarters of an Inch of the hinder end. This Groove is so wide all the way, that it may receive the Shank of the *Screw*. On the Fore-end of this Plate stands square upright another Iron Head about a *Brevier* thick, and reaches so high as the top of the Back.

The upper *Sliding-Measure* is made just like the lower, only it is about three quarters of an Inch shorter.

Between

Between the set two *Sliding-Measures*, *Marginal Notes* are *Composed* to any Width.

Composers commonly examine the Truth of their *Stick* by applying the head of the *Sliding-Measure* to the inside of the Head of the *Stick*; and if they comply, they think they are square and true made: But this Rule only holds when the Head it self is square. But if it be not, 'tis easy to file the *Sliding-Measures* to comply with them: Therefore, as aforesaid, the square is the only way to examine them by.

¶. 5. *Of the Bodkin.*

The *Bodkin* is delineated in Plate 2. at *F* Its *Blade* is made of *Steel*, and well tempered, its shape is round, and stands about two Inches without the *Shank* of the *Handle*. The *Handle* is turned of soft wood as *Alder*, *Maple*, &c. that when *Composers* knock the Head of the *Bodkin* upon the Face of a Single *Letter* when it stands too high, it may not batter the Face.

¶. 6. *Of Chases, marked G on the Correcting-Stone, Plate 2.*

A *Chase* is an Iron Frame about two and twenty Inches long, eighteen Inches broad, and half Inch half quarter thick; and the breadth of Iron on every side is three quarters of an Inch: But an whole Inch is much better, because stronger. All its sides must stand exactly square to each other; And when it is laid on the *Correcting-Stone* it must lye exactly flat,
viz.

viz. equally bearing on all its sides and Angles: The outside and inside must be Filed straight and smooth. It hath two *Crosses* belonging to it, *viz.* A *Short-Cross* marked *a a* and a *Long-Cross* marked *b b*: These two *Crosses* have on each end a Male Duftail Filed Bevil away from the under to the upper side of the *Cross*, so that the under side of the Duftail is narrower than the upper side of the Duftail. These Male-Duftails are fitted into Female-Duftails, Filed in the inside of the *Chase*, which are also wider on the upper side of the *Chase* than on the under side; because the upper side of the *Cross* should not fall through the lower side. These *Crosses* are called the *Short* and the *Long Cross*.

The *Short-Cross* is Duftail'd in as aforesaid, just in the middle of the *Chase* as at *c c*, and the *Long-Cross* in the middle of the other sides the *Chase*, as at *d d*. The *Short-Cross* is also Duftail'd into Female-Duftails, made as aforesaid, about three Inches and an half from the middle, as at *e e*: So that the *Short Cross* may be put into either of the Female-Duftails as occasion serves. The middle of these two *Crosses* are Filed or notched half way through, one on its upper, the other on its under side to let into one another, *viz.* the *Short-Cross* is Filed from the upper towards the under side half way, and the *Long-Cross* is Filed from the lower towards the upper-side half way: The *Crosses* are also thus let into each other, where they meet at *f*, when the *Short-Cross* is laid into the other Female-Duftails fitted to it at *e e*.

In the middle, between the two edges of the upper side of the *Short-Cross*, is made two Grooves parallel

rallel to the fides of the *Crofs*, beginning at about two Inches from each end, and ending at about feven Inches from each end: It is made about half an Inch deep all the way, and about a quarter of an Inch broad, that the *Points* may fall into them. The *Short-Crofs* is about three quarters of an Inch thick, and the *Long Crofs* about half that thicknefs. All their fides muft be Fil'd ftraight and fmooth, and they muft be all the way of an equal thicknefs.

Hitherto our *Mafter-Printer* hath provided Materials and Implements only for the *Compositers* ufe; But he muft provide Machines and Tools for the *Pressmans* to ufe too: which (because I am loath to discourage my Customers with a fwelling price at the firft reviving of thefe Papers) I fhall (though againft my intereft) leave for the fubject of the next fucceeding *Exercifes*.

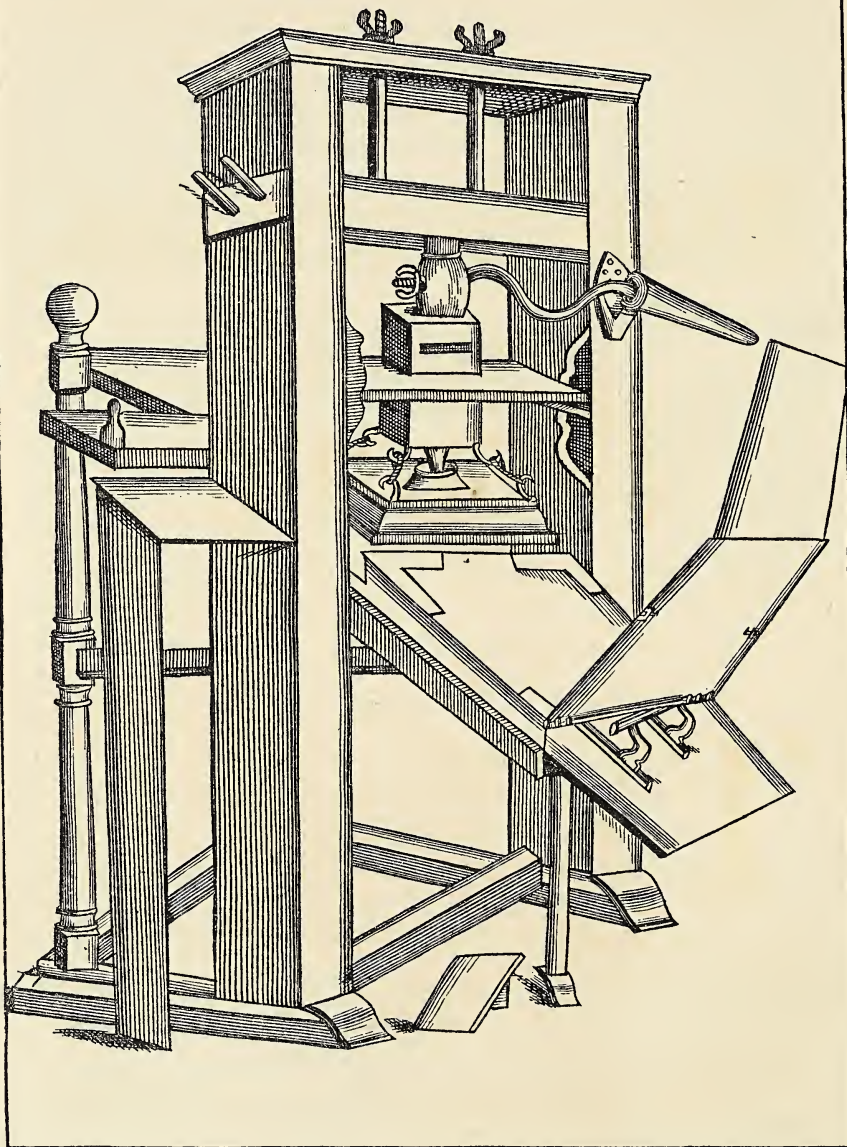
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THE *firft Volume of Mechanick Exercifes, Treating of the Smiths, the Joyners, the Carpenters, and the Turners Trades, containing 37½ sheets, and 18 Copper Cuts, are to be had by the Author. Joseph Moxon. Price 9 s. 3 d. in Quires.*

THe *firft Volume of the Monthly Collection of Letters for Improvement of Husbandry and Trade, containing Twenty four Sheets with an Index, is now finished, and the fecond is carrying on:*

By John Haughton, Fellow
of the Royal Society.

Plate 3.



MECHANICK EXERCISES:

Or, the Doctrine of

Handy-works.

Applied to the Art of

Printing.

§. 10. *Of the Presses.*

THere are two sorts of *Presses* in use, viz. the old fashion and the new fashion; The old fashion is generally used here in *England*; but I think for no other reason, than because many *Press-men* have scarce Reason enough to distinguish between an excellently improved Invention, and a make-shift slovenly contrivance, practiced in the minority of this Art.

The New-fashion'd *Presses* are used generally throughout all the *Low-Countries*; yet because the
Old-

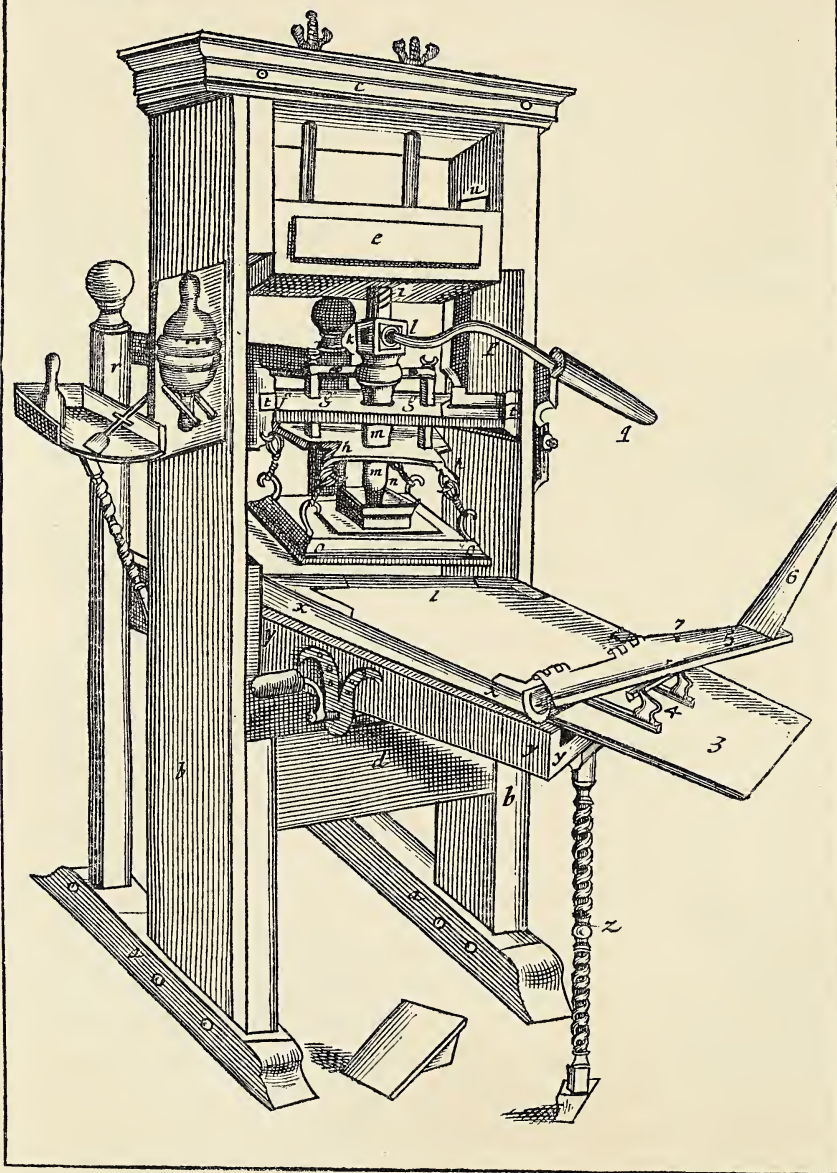
Old-fashion'd *Presses* are used here in *England* (and for no other Reason) I have in Plate 3. given you a delineation of them; But though I give you a draft of them; yet the demenſions of every particular Member I ſhall omit, referring thoſe that think it worth their while, to the *Joyners* and *Smiths* that work to *Printers*: But I ſhall give a full deſcription of the New-fashion'd *Preſs*, becauſe it is not well known here in *England*; and if poſſible, I would for Publick benefit introduce it.

But before I proceed, I think it not amiſs to let you know who was the Inventer of this New-fashion'd *Preſs*, accounting my ſelf ſo much oblig'd to his Ingeniety for the curioſity of this contrivance, that ſhould I paſs by this oppertunity without naming him, I ſhould be injurious to his Memory.

It was *Willem Janſen Blaew* of *Amſterdam*: a Man as well famous for good and great *Printing*, as for his many *Aſtronomical* and *Geographical* exhibitions to the World. In his Youth he was bred up to *Joyner*y, and having learn'd his Trade, betook himſelf (according to the mode of *Holland*) to Travel, and his fortune leading him to *Denmark*, when the noble *Tycho Brahe* was about ſetting up his *Aſtronomical Obſervatory*, was entertain'd into his ſervice for the making his Mathematical-Inſtruments to Obſerve withal; in which Inſtrument-making he ſhew'd himſelf ſo intelligent and curious, that according to the general report of many of his perſonal acquaintance, all or moſt of the *Syderal Obſervations* ſet forth in *Tycho's* name, he was intruſted to make, as well as the Inſtruments.

And

Plate 4.



And before these Observations were publish'd to the World, *Tycho*, to gratify *Blaeuw*, gave him the Copies of them, with which he came away to *Amsterdam*, and betook himself to the making of *Globes*, according to those Observations. But as his Trade increased, he found it necessary to deal in *Geographical Maps* and *Books* also, and grew so curious in *Engraving*, that many of his best *Globes* and *Maps* were *Engraved* by his own Hands; and by his conversation in *Printing* of Books at other *Printing-houses*, got such in-sight in this Art, that he set up a *Printing-house* of his own. And now finding inconveniencies in the obsolete Invention of the *Press*, He contrived a remedy to every inconvenience, and fabricated nine of these New-fashioned *Presses*, set them all on a row in his *Printing-house*, and call'd each *Press* by the name of one of the *Muses*.

This short History of this excellent Man is, I confess forraign to my Title; But I hope my Reader will excuse the digression, considering it tends only to the commemoration of a Person that hath deserved well of Posterity, and whose worth without this small Monument, might else perhaps have slid into Oblivion.

The *Press* is a Machine consisting of many Members; it is delineated in Plate 4.

a a The Feet.

b b The Cheeks.

c The Cap.

d The Winter.

e The Head.

f The Till.

g g The

g g The *Hofe*. In the Crofs-Iron of which, encompassing the *Spindle*, is the *Garter*.

h h h h The *Hooks* on the *Hofe* the *Plattin* hangs on.

i k l m n The *Spindle*.

i Part of the *Worm* below the *Head*, whose upper part lies in the *Nut* in the *Head*.

k l The *Eye* of the *Spindle*.

m The *Shank* of the *Spindle*.

n The *Toe* of the *Spindle*.

o o o o The *Plattin* tyed on the *Hooks* of the *Hofe*.

p The *Bar*.

q The *Handle* of the *Bar*.

r r The *Hind-Posts*.

s s The *Hind-Rails*.

t t The *Wedges* of the *Till*.

u u The *Morteffes* of the *Cheeks*, in which the *Tenants* of the *Head* plays.

x x x x y y The *Carriage*.

x x x x The outer *Frame* of the *Carriage*.

y y The *Wooden-Ribs* on which the *Iron-Ribs* are faſtned.

z The *Stay* of the *Carriage*, or the *Stay*.

1. The *Coffin*.

2. The *Gutter*.

3. The *Planck*.

4. The *Gallows*.

5. The *Tinpans*.

6. The *Frisket*.

7. The *Points*.

8. The *Point-Screws*.

All theſe ſeveral Members, by their Matter, Form and Poſition, do particularly contribute ſuch an aſſiſtance

fiftance to the whole Machine, that it becomes an Engine managable and proper for its intended purpose.

But because the smallness of this altogether-Draft may obscure the plain appearance of many of these Parts; Therefore I shall give you a more particular description, and large delineation of every Member in the *Press*: And first of the Wooden work: Where, *Note*, that all the Fram'd Wooden-work of a *Press* is made of Good, Fine, Clean, Well-season'd *Oak*.

¶. 1. *Of the Feet.*

The *Feet* (marked *a a* in Plate 5.) are two Foot nine Inches and an half long, five Inches deep; and six Inches broad, and have their out-sides Tryed to a true square, as was taught, *Numb. 5. §. 15*. It hath (for ornament sake) its two ends bevil'd away in a Molding, from its upper-side to its lower, about four Inches within the ends; about four Inches and three quarters within each end of each Foot is made in the middle of the Breadth of the upper-side of the Foot a Mortise two Inches wide, to receive the *Tennants* of the lower-end of the *Cheek*, and the *Tennant* of the lower end of the *Hind-Post*: The Mortise for the *Cheek* is eight Inches long, *viz.* the Breadth of the *Cheek*: And the Mortise for the *Hind-Post* is four Inches long, *viz.* the square of the *Hind-Post*.

¶. 2. *Of the Cheeks.*

The *Cheeks* (marked *b b* in Plate 5) are five Foot and ten Inches long (besides the *Tennants* of the top
and

and bottom) eight Inches broad, and four Inches and an half thick. All its Sides are tryed square to one another. It hath a *Tennant* at either end, its lower *Tennant* marked *a* to enter the Fore-end of the Foot, runs through the middle of the Breadth of the *Cheek*, which therefore is made to fit the Mortefs in the *Foot*, and is about four Inches long, and therefore reaches within an Inch of the bottom of the *Foot*; But the *Tennant* at the upper end of the *Cheek* marked *a*, is cut a-thwart the breadth of the *Cheek*, and therefore can have but four Inches and an half of Breadth, and its thicknefs is two Inches, Its length is four Inches; fo that it reaches into the Mortefs in the *Cap*, within half an Inch of the Top.

In the lower-end-*Tennant* is two holes bored, within an Inch and an half of either fide, and within an Inch and an half of the Sholder, with a three quarter Inch *Augure*, to be pin'd into the *Feet* with an Iron Pin.

In the middle of the upper *Tennant*, and within an Inch and an half of the Sholder, is bored another hole, to Pin the *Tennant* into the *Cap*, alfo with an Iron Pin.

Between *b c* two Foot and half an Inch, and three Foot feven Inches of the Bottom Sholder of the *Tennant*, viz. from the top of the *Winter* to the under Sholder the *Till* refts upon, is cut flat away into the thicknefs of the *Cheek*, three Inches in the Inſide of the *Cheek*; fo that in that place the *Cheek* remains but an Inch and an half thick: And the *Cheeks* are thus widened in this place, as well becauſe the Duftail *Tennants* of the *Winter* may go in between them, as alfo

so that the *Carriage* and *Coffin* may be made the wider.

Even with the lower Sholder of this flat cutting-in, is made a Duftail Mortefs as at *d*, to reach eight Inches and an half, *viz.* the depth of the *Winter* below the said Sholder. This Mortefs is three Inches wide on the infide the *Cheek*, and three Inches deep; But towards the infide the *Cheek*, the Mortefs widens in a ftraight line from the said three Inches to five Inches, and fo becomes a Duftail Mortefs. Into this Duftail Mortefs is fitted a Duftail *Tennant*, made at each end of the *Winter*.

Two Inches above the aforefaid Cutting-in, is another cutting-in of the fame depth, from the Infide the *Cheek* as at *e*. This cutting-in is but one Inch broad at the farther fide the *Cheek*, and an Inch and a quarter on the hither fide the *Cheek*. The under fide of this Cutting-in, is ftraight through the *Cheek*, *viz.* Square to the fides of the *Cheek*: But the upper fide of this Cutting-in, is not fquare through the *Cheeks*, But (as aforefaid) is one quarter of an Inch higher on the fore-fide the *Cheek* than it is on the further fide; So that a Wedge of an Inch at one end, and an Inch and a quarter at the other end may fill this Cutting-in.

At an Inch within either fide the *Cheek*, and an Inch below this Cutting-in, as at *ff*, is made a fmall Mortefs an Inch and an half wide, to which two *Tennants* muft be fitted at the ends of the *Till*, fo that the *Tennants* of the *Till* being flid in through the Cutting-in aforefaid, may fall into thefe Morteffes, and a Wedge being made fit to the Cutting-in, may prefs upon the *Tennants* of the *Till*, and force it down to keep it fteddy in its place. Here

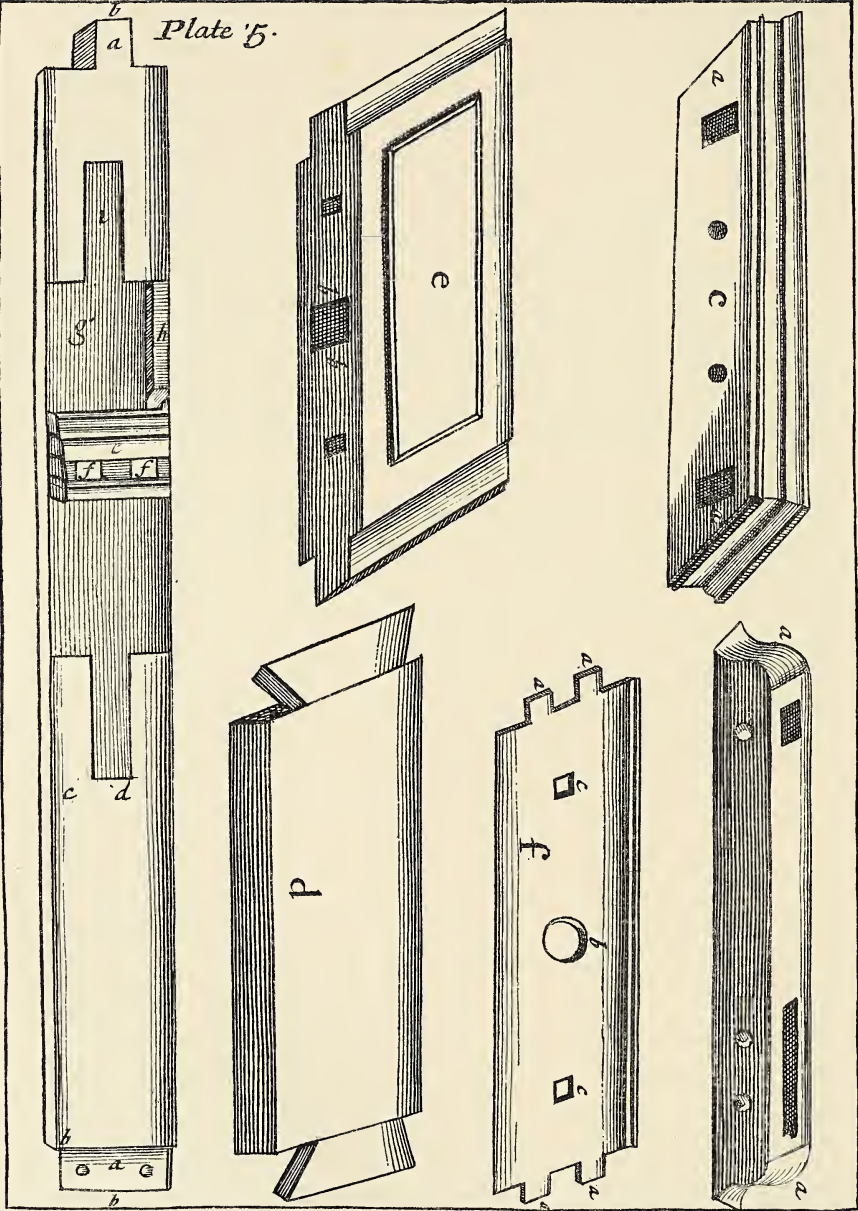
Here we see remains a square Shoulder or substance of Wood between two Cuttings-in; But the under corner of this square Shoulder is for Ornament-fake Bevil'd away and wrought into an *Ogee*.

At two Inches above the last Cutting-in, is another Cutting-in, but this Cutting-in goes not quite through the breadth of the *Cheek*, but stops at an Inch and an half within the further side the *Cheek*; So that above the *Till* and its *Wedge* is another Shoulder or substance of Wood, whose upper Corner is also Bevil'd away, and wrought to a Molding as the former.

The last Cutting-in is marked *g*, and is eight Inches and a quarter above the Shoulder of the *Till*, that it may easily contain the depth of the *Head*; The substance remaining is marked *h*. This Cutting-in is made as deep into the thickness of the *Cheek* as the former Cuttings-in are, *viz.* three Inches; and the reason the *Cheek* is cut-in here, is, that the *Cheeks* may be wide enough in this place to receive the *Head*, and its *Tennants*, without un-doing the *Cap* and *Winter*.

Just above this Cutting-in is made a square Mortise in the middle of the *Cheek*, as at *i*, it is eight Inches long, and two Inches and an half wide, for the *Tennant* of the *Head* to play in.

Upon the fore-side of the *Cheek* is (for Ornament fake) laid a Molding through the whole length of the *Cheek* (a square at the Top and Bottom an Inch deep excepted) it is laid on the outer side, and therefore can be but an Inch broad; Because the Cuttings-in on the inside leaves the substance of Stuff but an
Inch



Inch and an half thick, and should the Moldings be made broader, it would be interrupted in the several Cuttings in, or else a square of a quarter of an Inch on either side the Molding could not be allowed, which would be ungraceful.

¶ 3. *Of the Cap marked c in Plate 5.*

The *Cap* is three Foot and one Inch long, four Inches and an half deep, and nine Inches and an half broad; But its fore-side is cut away underneath to eight Inches, *Viz.* the breadth of the *Cheeks*. Three quarters of an Inch above the bottom of the *Cap*, is a small *Facia*, which stands even with the thickness of the *Cheeks*; Half an Inch above that a Bead-Molding, projecting half an Inch over the *Facia*. Two Inches above that a broad *Facia*, also even with the thickness of the *Cheeks*; and an Inch and a quarter above that is the upper Molding made projecting an Inch and an half over the two *Facia*'s aforesaid, and the thickness of the *Cheeks*.

Each end of the *Cap* projects three Inches quarter and half quarter over the *Cheeks*, partly for Ornament, but more especially that substance may be left on either end beyond the Mortesses in the *Cap*; and these two ends have the same Molding laid on them that the fore-side of the *Cap* hath.

Within two Inches and half quarter of either end, on the under-side the *Cap* is made a square Mortess two Inches wide, and four Inches and an half long, *viz.* the thickness of the *Cheek* inwards, as at *a a*, to receive the Top *Tennants* of the *Cheeks*; which Top
Tennants

Tennants are with an Iron Pin (made tapering of about three quarters of an Inch thick) pin'd into the Mortifes of the *Cap*, to keep the *Cheeks* fteddy in their pofition.

¶. 4. *Of the Winter marked d in Plate 5.*

The Length of the *Winter* befides the *Tennants*, is one Foot nine Inches and one quarter of an Inch; The Breadth of the *Winter* eight Inches, viz. the Breadth of the *Cheek*, and its depth nine Inches; all its fides are tryed fquare; But its two ends hath each a Duftail-*Tenant* made through the whole depth of the *Winter*, to fit and fall into the Duftail Mortifes made in the *Cheeks*: Thefe Duftail-*Tennants* are intended to do the Office of a *Summer*, Because the fpreading of the ends of thefe two *Tennants* into the fpreading of the Mortiffes in the *Cheeks*, keeps the two *Cheeks* in a due diftance, and hinders them from flying afunder.

But yet I think it very convenient to have a *Summer* alfo, the more firmly and furer to keep the *Cheeks* together; This *Summer* is only a Rail *Tennanted*, and let into Mortiffes made in the infide of the *Cheeks*, and Screwed to them as the Rails defcribed, Numb. 15. §. 4. are Screwed into the Stiles of the *Cafe-Frame*; Its depth four Inches and an half, and its breadth eight Inches, viz, the breadth of the *Cheeks*.

¶. 5. *Of*

¶. 5. *Of the Head marked e in Plate 5.*

The length of the *Head* besides the *Tennant* at either end, is one Foot nine Inches and one quarter of an Inch; The breadth eight Inches and an half, and its depth eight Inches. The Top, Bottom and Hind-sides are tryed Square, but the fore-side projects half an Inch over the Range of the fore-sides of the *Cheeks*; in which Projecture is cut a Table with a hollow Molding about it, two Inches distant from all the sides of the fore-side of the *Head*: Its *Tennants* are three Inches Broad, and are cut down at either end, from the top to the bottom of the *Head*, and made fit to the Morteasses in the *Cheeks*, that they may slide tight, and yet play in them.

In the under-side of the *Head* is cut a square Hole, (as at *a*,) about four Inches square, and three Inches and an half deep, into which the *Brafs-Nut* is to be fitted: And to keep this *Nut* in its place (lest the weight of it should make it fall out) is made on either side the square hole, at about half an Inch distance from it, (as at *b b*) a square Hole quite through the Top and Bottom of the *Head* about three quarters of an Inch wide; and into this square Hole is fitted a square piece of Iron to reach quite through the *Head*, having at its under-end a Hook turned square to claspe upon the under-side of the *Nut*; and on its upper-end a Male-Screw reaching about an Inch above the upper-side of the *Head*, which by the help of a Female-screw made in an Iron *Nut*, with Ears to it to turn it about draws the *Clasp* at the bottom of the Iron *Shank* close

close against the *Nut*, and so keeps it from falling out.

In the middle of the wide square Hole that the *Nut* is let into, is bored a round Hole through the top of the *Head*, of about three quarters of an Inch wide, for the *Press-man* to pour *Oyl* in at so oft as the *Nut* and *Spindle* shall want *Oyling*.

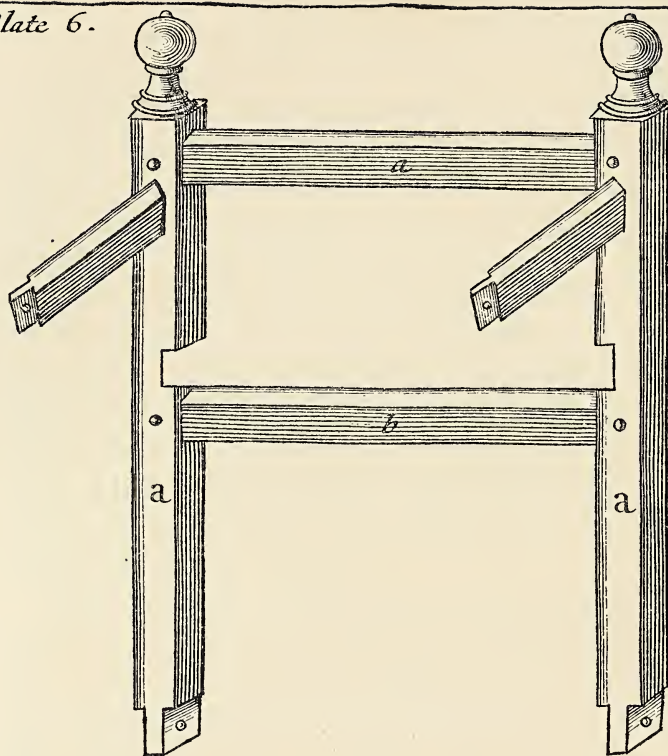
At three Inches from either end of the *Head* (as at *c c*) is bored a Hole quite through the top and bottom of the *Head*, which holes have their under ends squar'd about two Inches upwards, and these squares are made so wide as to receive a square Bar of Iron three quarters of an Inch square; But the other part of these Holes remain round: Into these Holes two Irons are fitted called the *Screws*.

The Shanks of these *Screws* are made so long as to reach through the *Head* and through the *Cap*: At the upper-end of these Shanks is made Male-screws, and to these Male-screws, Iron Female-screws are fitted with two Ears to twist them the easier about.

So much of these Iron Shanks as are to lye in the square Hole of the *Head* aforesaid, are also squared to fit those square Holes, that when they are fitted and put into the Holes in the *Head*; they may not twist about.

To the lower-ends of these Iron-Shanks are made two Square, Flat Heads, which are let into and buried in the under-side of the *Head*; And upon the Sholders of those two Flat Heads, rests the weight of the *Head* of the *Press*; And by the *Screws* at the Upper-end of the Shanks are hung upon the upper-side of the *Cap*, and Screwed up or let down as occasion requires.

Plate 6.



b



¶. 6. *Of the Till, marked f in Plate 5.*

The *Till* is a Board about one Inch thick, and is as the *Head* and *Winter*, one Foot nine Inches and a quarter long, besides the *Tennants* at either end; Its Breadth is the Breadth of the *Cheeks*, viz. eight Inches; It hath two *Tennants* at either end as at *a a a a*, each of them about an Inch and an half long, and an Inch and an half broad, and are made at an Inch distance from the fore and Back-side, so that a space of two Inches is contained in the middle of the ends between the two *Tennants*; these *Tennants* are to be laid in the Mortesses in the *Cheeks* delineated at *ff* in Plate 5. and described in this §. 10. ¶. 2.

In its middle it hath a round Hole about two Inches and an half wide, as at *b*, for the Shank of the *Spindle* to pass through.

At seven Inches and a quarter from either end, and in the middle between the Fore and Back-side, is made two square Holes through the *Till*, as at *c c*, for the Iron *Hose* to pass through.

¶. 7. *Of the Hind-Posts marked a a in Plate 6.*

At one Foot distance from the Hind-sides of the *Cheeks* are placed upright two *Hind-Posts*, they are three Foot and four Inches long besides the *Tennants*, which *Tennants* are to be placed in the Mortesses in the hinder ends of the *Feet*; Their thickness is four Inches on every side, and every side is tryed square;
But

But within eight Inches of the top is turned a round Ball with a Button on it, and a Neck under it, and under that Neck a straight Plinth or Base: This turn'd work on the top is only for Ornament sake.

There are six *Rails* fitted into these *Hind-Posts*, two behind marked *a b*, one of them standing with its upper side at two Inches below the turned Work, the other having its upper-side lying level with the upper-side of the *Winter*.

These two *Rails* are each of them *Tennanted* at either end, and are made so long, that the out-sides of the *Hind-Posts* may stand Range or even with the outer-sides of the *Cheeks*; These *Tennants* at either end are let into Mortises made in the in-sides of the *Hind-Posts*, and Pin'd up with half Inch wooden Pins, Glewed in, as was shewn Vol. 1. Numb. 5. §. 17. Because the two *Hind-Posts* need not be separated for any alteration of the *Press*.

The two *Side-Rails* on either side the *Press* are *Tennanted* at each end, and let into Mortises made in the *Cheeks* and *Hind-Posts*, so as they may stand Range with the outer-sides of the *Cheeks* and *Hind-Posts*; But the *Tennants* that enter the Mortises in the *Cheeks* are not pin'd in with Wooden Pins, and Glewed, because they may be taken assunder if need be; But are Pin'd in with Iron Pins, made a little tapering towards the entering end, so as they may be driven back when occasion serves to alter the *Press*: And the *Tennants* that enter the Mortises in the *Hind-Posts* are fastned in by a Female-screw, let in near the end of the *Rail*, which receives a Male-screw thrust through the *Hind-Posts*, even as I shew'd in
§. 4.

§. 4. the *Fore* and *Back-Rails* of the *Cafe-Frames* was.

¶. 8. *Of the Ribs marked b in Plate 6.*

The *Ribs* lye within a Frame of four Foot five Inches long, one Foot eleven Inches broad; its two *End-Rails* one Inch and an half thick, its *Side-Rails* two Inches and an half thick; and the breadth of the *Side* and *End-Rails* two Inches and an half. But the *Side-Rails* are cut away in the in-side an Inch and an half towards the outer sides of the *Rails*, and an Inch deep towards the Bottom sides of the *Rails*, so that a square *Cheek* on either *Side-Rail* remains. This cutting down of the *Outer-Rails* of the *Frame* is made, because the Planck of the *Carriage* being but one Foot eight Inches and an half broad, may easily slide, and yet be gaged between these *Cheeks* of the *Rail*, that the *Cramp-Irons* Nailed under the *Carriage Planck* joggle not on either side off the *Ribs*, as shall more fully be shewn in the next §.

Between the two *Side-Rails* are framed into the two *End-Rails* the two *Wooden-Ribs* two Inches and an half broad, and an Inch and an half thick; they are placed each at an equal distance from each *Side-Rail*, and also at the same distance between themselves. Upon these two *Ribs* are fast Nailed down the *Iron-Ribs*, of which more shall be said when I come to speak of the *Iron-work*.

¶. 9. *Of*

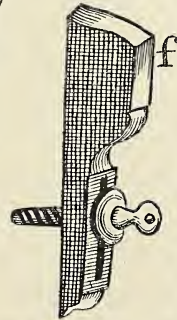
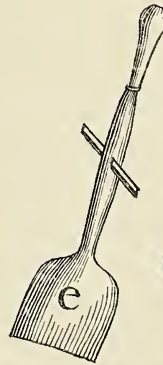
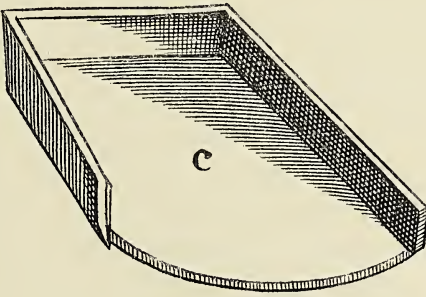
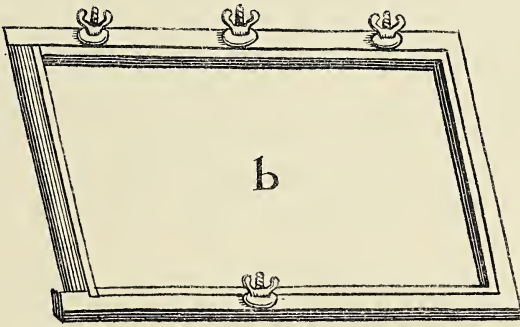
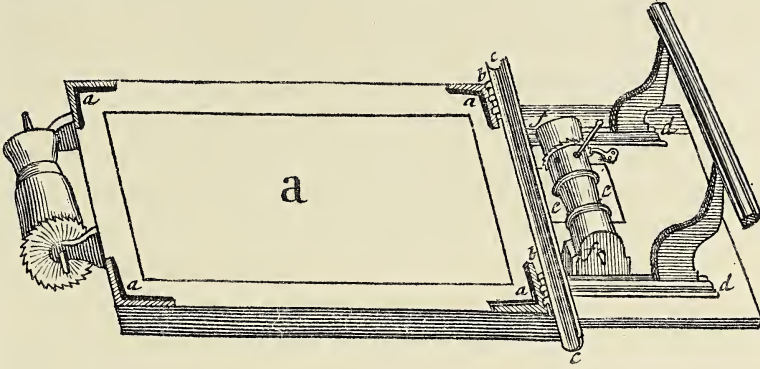
¶. 9. *Of the Carriage, Coffin and its Planck, marked a in Plate 7.*

The *Planck* of the *Carriage* is an Elm-Planck an Inch and an half thick, four Foot long, and one Foot eight Inches and three quarters broad; upon this *Planck* at its fore-end is firmly Nailed down a square Frame two Foot four Inches long, one Foot ten Inches broad, and the thickness of its Sides two Inches and an half square; This Frame is called the *Coffin*, and in it the *Stone* is *Bedded*.

Upon each of the four Corners of this *Coffin* is let in and fastned down a square Iron Plate as at *a a a a*, with Return Sides about six Inches long each side, half a quarter of an Inch thick, and two Inches and a quarter broad; upon the upper outer-sides of each of these Plates is fastned down to them with two or three Rivets through each side, another strong Iron half an Inch deep, and whose outer Angles only are square, but the Inner Angles are obtuse, as being sloped away from the Inner-Angle towards the farther-end of each inner-side, so as the *Quoins* may do the Office of a Wedge between each inner-side and the *Chase*.

The Plates of these Corners (as I said) are let in on the outer-Angles of the upper-side of the Frame of the *Coffin*, so as the upper-sides of the Plates lye even with it, and are Nailed down, or indeed rather Rivetted down through the bottom and top-sides of the Frame of the *Coffin*, because then the upper-sides of the Holes in the Iron Plates being square
Bored

Plate 7.



Bored (that is, made wider on the upper side of the Plate, as I shew when I come to the making of *Mathematical Instruments*) the ends of the Shanks of the Iron Pins may be so battered into the Square-boring, that the whole Superficies of the Plate when thus Rivetted shall be smooth, which else with the exturberancies of Nail-heads would hinder the free sliding of the *Quoins*.

At the hinder end of the Frame of the *Coffin* are fastned either with strong Nails, Rivets, or rather Screws, two Iron *Half-Joynts*, as at *b b*, which having an Iron Pin of almost half an Inch over put through them, and two *Match-half-Joynts* fastned on the Frame of the *Tympan*, these two *Match-half-Joynts* moving upon the Iron Pin aforesaid, as on an *Axis*, keeps the *Tinpan* so truly gaged, that it always falls down upon the *Form* in the place, and so keeps *Register* good, as shall further be shewed in proper place.

Behind the *Coffin* is Nailed on to its outside, a Quarter, as at *c c* this Quarter is about three Inches longer than the breadth of the *Coffin*, it hath all its sides two Inches over, and three of them square; but its upper side is hollowed round to a Groove or Gutter an Inch and an half over. This Gutter is so Nailed on, that its hither end standing about an Inch higher than its further end, the Water that descends from the *Tympan* falling into it is carried away on the farther side the *Coffin* by the declivity of the farther end of the Gutter, and so keeps the Planck of the *Carriage* neat and cleanly, and preserves it from rotting.

Parallel

Parallel to the outer fides of the hind part of the Planck of the *Carriage*, at three Inches diftance from either fide, is Nailed down on the upper fide of the Planck two Female-Duftail Grooves, into which is fitted (fo as they may flide) two Male-Duftails made on the two Feet of the *Gallows* (as at *d d*) that the *Tinpan* refts upon; and by the fliiding forward or backward of thefe Duftail Feet, the heighth of the *Tinpan* is raifed or deprefsed according to the Reafon or Fancy of the *Preff-man*.

At three Inches from the hinder Rail of the *Coffin*, in the middle, between both fides of the Planck, is cut an Hole four Inches fquare (as at *e e*) and upon the hither and farther fide of this Hole is faftened down on each fide a *Stud* made of Wood (as at *f f*) and in the middle of thefe two *Studs* is made a round Hole about half an Inch over, to receive the two round ends of an Iron Pin; which Iron Pin, though its ends be round, is through the middle of the Shank fquare, and upon that fquare is fitted a round *Wooden-Rowler* or *Barrel*, with a Shoulder on either fide it, to contain fo much of the *Girt* as fhall be rowled upon it; And to one end of the *Rowler* is faftened an Iron *Circle* or *Wheel*, having on its edge *Teeth* cut to flop againft a *Clicker*, when the *Rowler* with an Iron Pin is turned about to ftrain the *Girt*.

¶. 10. *Of the Tympan and Inner-Tympan, marked b in Plate 7.*

The *Tympan* is a fquare Frame, three fides whereof are Wood, and the fourth Iron. Its width is one
Foot

Foot eight Inches, its length two Foot two Inches; the breadth of the wooden Sides an Inch and an half, and the depth one Inch.

On its short Wooden-side, *viz.* its Hind-end, at the two Corners is Rivetted an Iron *Match-Joynt*, to be pinned on to another *Half joynt* fastned on the *Hind-Rail* of the *Coffin*.

The other end, *viz.* the Fore-end of the *Tympan* is made of Iron, with a square *Socket* at either end for the Wooden ends of the *Tympan* to fit and fasten into. This Iron is somewhat thinner and narrower than an ordinary Window-Casement.

Upon the outer edge of this Iron, about an Inch and an half off the ends of it, is made two Iron *Half-joynts* to contain a Pin of about a quarter of an Inch over, which Pin entring this *half-joynt*, and a *match Half-joynt* made upon the *Frisket*, serves for the *Frisket* to move truly upon.

In the middle of each long *Rail* of the *Tympan*, is made through the top and bottom an Hole half an Inch square, for the square Shanks of the *Point-Screws* to fit into.

The like Holes are also made in the *Tympan*, at one third part of its length from the Fore-end or *Frisket-joynt*, to place the *Point Screws* in; when a *Twelves*, *Eighteens*, &c. is wrought.

Into the Inner-side of this *Tympan* is fitted the *Inner-Tympan*, whose three sides are also made of Wood, and its fourth side of Iron, as the *Tympan*, but without *joynts*; it is made so much shorter than the *Outer-Tympan*, that the outer edge of the Iron of the *Inner-Tympan* may lye within the inner edge of the Iron on the *Outer-Tympan*;

pan; and it is made fo much narrower than the infide of the *Tympan*, that a convenient room may be allowed to pafte a *Vellom* between the infide of the *Tympan*, and the outfide of the *Inner-Tympan*.

About the middle, through the hither-fide of the *Inner-Tympan*, is let in and faftned an Iron Pin about a quarter of an Inch over, and ftands out three quarters of an Inch upon the hither out-fide of the *Inner-Tympan*, which three quarters of an Inch Pin fits into a round hole made in the inner-fide of the *Tympan*, to gage and fit the *Inner-Tympan* right into the *Tympan*; for then by the help of an Iron turning *Clafp* on the further fide the *Tympan*, the *Inner-Tympan* is kept firmly down and in its pofition.

¶ 11. *Of the Inck-Block, Slice, Brayer, and Catch of the Bar, marked c d e f in Plate 7.*

To the *Rail* between the hither *Cheek* and *Hind-Post* is faftned the *Inck-Block*, which is a Beechen-board about thirteen Inches long, nine Inches broad, and commonly about two Inches thick, and hath the left hand outer corner of it cut away; it is Railed in on its farther and hinder-fides, and a little above half the hither-fide, with Wainfcot-Board about three quarters of an Inch thick, and two Inches and an half above the upper-fide the board of the *Inck-Block*. It is defcribed in Plate 7. at c.

The *Brayer* marked *a* is made of *Beech*: It is turned round on the fides, and flat on the bottom, its length
is

is about three Inches, and its diameter about two Inches and an half; it hath an Handle to it about four Inches long. Its Office is to rub and mingle the *Inck* on the *Inck-Block* well together.

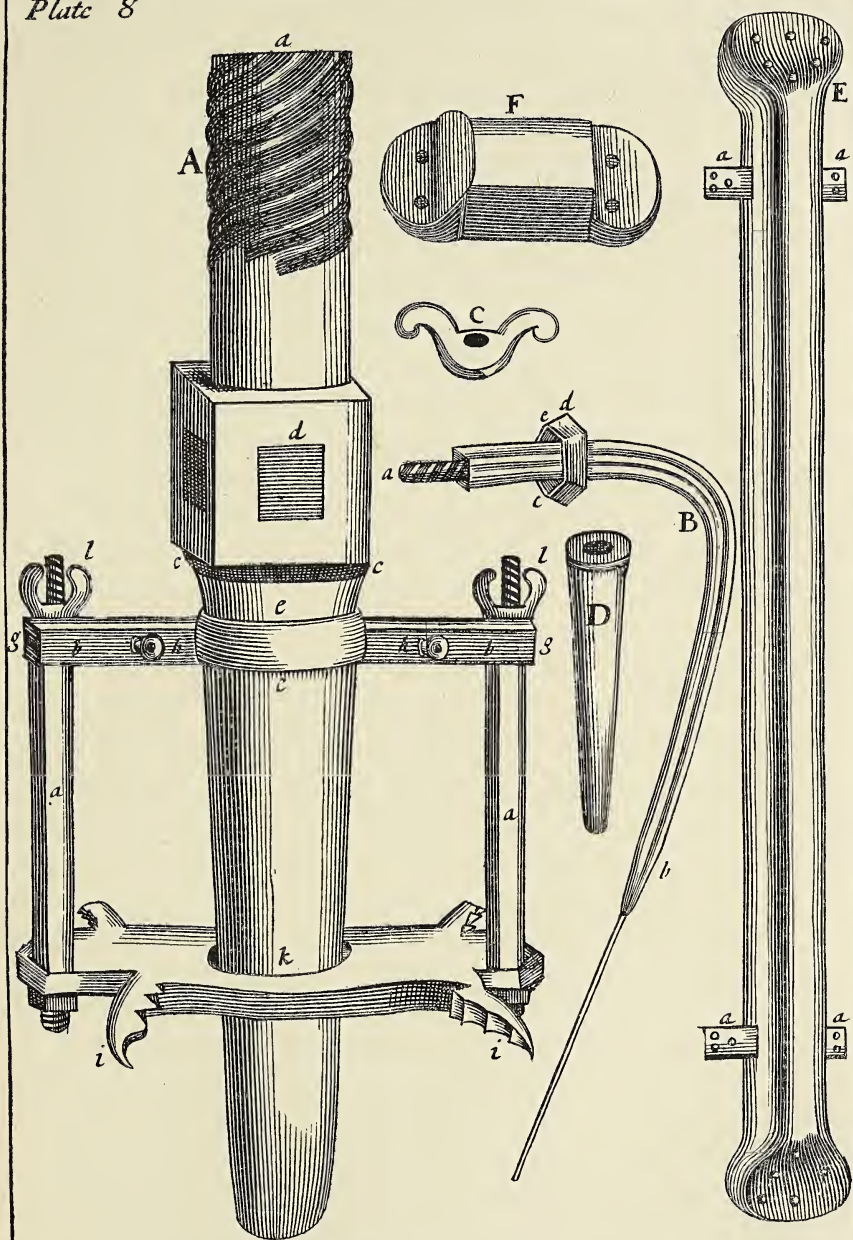
The *Slice* is a little thin Iron *Shovel* about three or four Inches broad, and five Inches long; it hath an Handle to it of about seven Inches long. Near the *Shovel* through the Handle is fitted a small Iron of about two Inches long standing Perpendicular to both the sides of the Handle, and is about the thickness of a small Curtain-Rod. It is described at e.

The *Catch* of the *Bar* described at f is a piece of Wood two Inches thick, four Inches broad, and ten Inches long; The top of it is a little Bevil'd or Slop'd off, that the *Bar* may by its *Spring* fly up the Bevil till it stick. This Bevil projects three Inches over its straight Shank, which reaches down to the bottom; in the middle of this Shank, through the fore and back-side, is a Mortefis made from within an Inch of the Rounding to an Inch and an half of the bottom; This Mortefis is three quarters of an Inch wide, and hath an Iron Pin with a Shoulder at one end fitted to it, so as it may slide from one end of the Mortefis to the other. At the other end of the Iron Pin is made a Male-Screw which enters into a Female Iron Screw let into the further *Cheek* of the *Press*; so that the *Catch* may be Screwed close to the *Cheek*, as shall further be spoken to hereafter.

¶. 12. *Of the Iron-work, and first of the Spindle marked A in Plate 8.*

From the Top to the *Toe* of the *Spindle*, viz. from *a* to *b* is sixteen Inches and a half, the length of the Cilinder the *Worms* are cut upon is three Inches and a quarter, and the diameter of that Cilinder two Inches and a quarter; between the bottom of the *Worms* and top of the Cube one Inch and an half; the Cube marked *c c c c* is two Inches and three quarters, the square *Eye* at *d* in the middle of the Cube is an Inch and a quarter through all the sides of the Cube; one Inch under the Cube at *e* is the *Neck* of the *Spindle*, whose diameter is two Inches, It is one Inch between the two shoulders, viz. the upper and under shoulders of the *Neck* at *e e*, so that the Cilinder of the *Neck* is one Inch long; the very bottom of the *Spindle* at *b* is called the *Toe*, it is made of an Hemispherical form, and about one Inch in diameter; This *Toe* should be made of *Steel*, and well Temper'd, that by long or careless usage, the point of pressure wear not towards one side of the *Toe*, but may remain in the Axis of the *Spindle*.

§. 11. *Of*



§. 11. *Of the Worms of the Spindle.*

I promised at the latter end of *Numb. 2.* to give a more copious account than there I did of making *Worms*, when I came to exercise upon *Printing-Prefs Spindles*; and being now arrived to it, I shall here make good my promise.

¶ 1. The *Worms* for *Printing-Prefs Spindles* must be projected with such a declivity, as that they may come down at an assigned progress of the *Bar*.

The assigned progress may be various, and yet the *Spindle* do its office: For if the *Cheeks* of the *Prefs* stand wide assunder, the sweep or progress of the same *Bar* will be greater than if they stand nearer together.

It is confirm'd upon good consideration and Reason as well as constant experience, that in a whole Revolution of the *Spindle*, in the *Nut*, the *Toe* does and ought to come down two Inches and an half; but the *Spindle* in work seldom makes above one quarter of a Revolution at one *Pull*, in which sweep it comes down but half an Inch and half a quarter of an Inch; and the reason to be given for this coming down, is the squeezing of the several parts in the *Prefs*, subject to squeeze between the Mortises of the *Winter* and the Mortises the *Head* works in; and every Joynt between these are subject to squeeze by the force of a *Pull*. As first, The *Winter* may squeeze down into its Mortise one third part of the thickness of a *Scabbord*. (Allowing a *Scabbord* to be half a *Nomparel* thick.) Secondly, The *Ribs* squeeze closer to the
the

the *Winter* one *Scabbord*. Thirdly, The *Iron-Ribs* to the *Wooden Ribs* one *Scabbord*. Fourthly, The *Cramp-Irons* to the *Planck* of the *Coffin* one *Scabbord*. Fifthly, The *Planck* it self half a *Scabbord*. Sixthly, The *Stone* to the *Planck* one *Scabbord*. Seventhly, The *Form* to the *Stone* half a *Scabbord*. Eighthly, The *Justifiers* in the *Mortels* of the *Head* three *Scabbords*. Ninthly, The *Nut* in the *Head* one *Scabbord*. Tenthly, The *Paper*, *Tympans* and *Blankets* two *Scabbords*. Eleventhly, Play for the *Irons* of the *Tympans* four *Scabbords*. Altogether make fifteen *Scabbords* and one third part of a *Scabbord* thick, which (as aforefaid) by allowing two *Scabbords* to make a *Nomparel*, and as I shewed in *Vol. 2. Numb. 2. §. 2.* One hundred and fifty *Nomparels* to make one Foot, gives twelve and an half *Nomparels* for an Inch, and consequently twenty five *Scabbords* for an Inch; so by proportion, fifteen *Scabbords* and one third part of a *Scabbord*, gives five eighth parts of an Inch, and a very small matter more, which is just so much as the *Toe* of the *Spindle* comes down in a quarter of a Revolution.

This is the Reason that the coming down of the *Toe* ought to be just thus much; for should it be less, the natural Spring that all these Joynts have, when they are unqueez'd, would mount the *Irons* of the *Tympans* so high, that it would be troublesom and tedious for the *Press-man* to Run them under the *Plat-tin*, unless the *Cheeks* stood wider assunder, and consequently every sweep of the *Bar* in a *Pull* exceed a quarter of a Revolution, which would be both laborious for the *Press-man*, and would hinder his usual riddance of Work.

I shew'd

I shew'd in *Numb. 2. fol. 31, 32, 33, 34, 35.* the manner of making a Screw in general; but assigned it no particular Rife; which for the aforefaid reason, these *Printing-Prefs Screws* are strictly bound to have: Therefore its assigned Rife being two Inches and an half in a Revolution, This measure must be set off upon the Cilindrick Shank, from the top towards the Cube of the *Spindle*, on any part of the *Cilinder*, and there make a small mark with a fine *Prick-Punch*, and in an exact Perpendicular to this mark make another small mark on the top of the *Cilinder*, and laying a straight *Ruler* on these two marks, draw a straight line through them, and continue that line almost as low as the Cube of the *Spindle*. Then divide that portion of the straight line contained between the two marks into eight equal parts, and set off those equal parts from the two Inch and half mark upwards, and then downwards in the line so oft as you can: Divide also the Circumference of the Shank of the *Cilinder* into eight equal parts, and draw straight lines through each division, parallel to the first upright line; and describe the *Screw* as you were directed in the afore-quoted place; so will you find that the revolution of every line so carried on about the Shank of the *Cilinder*, will be just two Inches and an half off the top of the Shank: which measure and manner of working may be continued downward to within an Inch and an half of the Cube of the *Spindle*. This is the Rule and Measure that ought to be observ'd for ordinary *Presses*: But if for some by-reasons the aforefaid Measure of two Inches and an half must be varied, then the varied Measure
must

mu&st be set off from the top of the Cilinder, and working with that varied Measure as hath been directed, the *Toe* of the *Spindle* will come down lower in a revolution if the varied Measure be longer, or not so low if the varied Measure be shorter.

There is a Notion vulgarly accepted among Workmen, that the *Spindle* will Rise more or less for the number of *Worms* winding about the Cilinder; for they think, or at least by tradition are taught to say, that a *Three-Worm'd Spindle* comes faster and lower down than a *four-Worm'd Spindle*: But the opinion is false; for if a *Spindle* were made but with a *Single-Worm*, and should have this Measure, viz. Two Inches and an half set off from the top, and a *Worm* cut to make a Revolution to this Measure, it would come down just as fast, and as low, as if there were two, three, four, five or six *Worms*, &c. cut in the same Measure: For indeed, the numbers of *Worms* are only made to preserve the *Worms* of the *Spindle* and *Nut* from wearing each other out the faster; for if the whole stress of a *Pull* should bear against the Shoulder of a single *Worm*, it would wear and shake in the *Nut* sooner by half than if the stress should be borne by the Shoulders of two *Worms*; and so proportionably for three, four, five *Worms*, &c.

But the reason why four *Worms* are generally made upon the *Spindle*, is because the Diameters of the *Spindle* are generally of this propos'd size; and therefore a convenient strength of Mettal may be had on this size for four *Worms*; But should the Diameter of the *Spindle* be smaller, as they sometimes are when the *Press* is designed for small Work, only three *Worms* will

will be a properer number than four; because when the Diameter is small, the thickness of the *Worms* would also prove small, and by the stress of a *Pull* would be more subject to break or tear the *Worms* either of the *Spindle* or *Nut*.

And thus I hope I have performed the promise here I made at the latter end of *Numb. 2*. Whither I refer you for the breadth, and reason of the breadth of the *Worm*.

¶. 13. *Of the Bar marked B in Plate 8.*

This *Bar* is Iron, containing in length about two Foot eight Inches and an half, from *a* to *b*, and its greatest thickness, except the Sholder, an Inch and a quarter; The end *a* hath a Male-Screw about an Inch Diameter and an Inch long, to which a *Nut* with a Female-Screw in it as at *C* is fitted. The Iron *Nut* in which this Female-Screw is made, must be very strong, *viz.* at least an Inch thick, and an Inch and three quarters in Diameter; in two opposite sides of it is made two Ears, which must also be very strong, because they must with heavy blows be knock't upon to draw the Sholder of the square shank on the *Bar*, when the square Pin is in the *Eye* of the *Spindle* close and steddily up to the Cube on the *Spindle*. The square Pin of the *Bar* marked *c* is made to fit just into the *Eye*, through the middle of the Cube of the *Spindle*, on the hither end of this square Pin is made a Sholder or stop to this square Pin, as at *d*. This Sholder must be Filed exactly Flat on all its four in-sides, that they may be drawn close and tight up
to

to any flat side of the Cube on the *Spindle*; It is two Inches square, that it may be drawn the firmer, and stop the steddier against any of the flat sides of the said Cube, when it is hard drawn by the strength of the Female-Screw in the aforesaid *Nut* at C. The thickness from *d* to *e* of this Sholder is about three quarters of an Inch, and is Bevil'd off towards the *Handle* of the *Bar* with a small Molding.

The substance of this *Bar*, as aforesaid, is about an Inch and a quarter; but its Corners are all the way flattened down till within five Inches of the end: And from these five Inches to the end, it is taper'd away, that the *Wooden-Handle* may be the stronger forced and fastned upon it.

About four Inches off the Sholder, the *Bar* is bowed beyond a right Angle, yet not with an Angle, but a Bow, which therefore lies ready to the *Press-man's* Hand, that he may Catch at it to draw the *Wooden-Handle* of the *Bar* within his reach.

This *Wooden-Handle* with long Working grows oft loose; but then it is with hard blows on the end of it forced on again, which oft splits the *Wooden-Handle* and loosens the square Pin at the other end of the *Bar*, in the *Eye* of the *Spindle*: To remedy which inconvenience, I used this Help, *viz.* To weld a piece of a Curtain-Rod as long as the *Wooden-Handle* of the *Bar*, to the end of the Iron *Bar*, and made a Male-screw at the other end with a Female-screw to fit it; Then I bored an hole quite through the *Wooden-Handle*, and Turn'd the very end of the *Wooden-Handle* with a small hollow in it flat at the bottom, and deep enough to bury the Iron-*Nut* on the end of the Cur-
tain-

tain-Rod, and when this Curtain-Rod was put through the Hollow in the *Wooden Handle* and Screwed fast to it at the end, it kept the *Wooden-Handle*, from flying off; Or if it loosened, by twisting the *Nut* once or twice more about, it was fastned again.

¶. 14. *Of the Hose, Garter, and Hose-Hooks.*

The *Hose* are the upright Irons in Plate 8. at *a a*, They are about three quarters of an Inch square, both their ends have Male-screws on them; The lower end is fitted into a square Hole made at the parting of the *Hose-Hooks*, which by a square *Nut* with a Female-screw in it, is Screwed tight up to them; Their upper ends are let into square Holes made at the ends of the *Garter*, and by *Nuts* with Female-Screws in them, and Ears to turn them about as at *l l* are drawn up higher, if the *Plattin-Cords* are too loose; or else let down lower if they are too tight: These upper Screws are called the *Hose-Screws*.

The *Garter* (but more properly the *Collar*) marked *b b*, is the round Hoop incompassing the flat Groove or Neck in the Shank of the *Spindle* at *e e*; This round Hoop is made of two half round Hoops, having in a Diametrical-line without the Hoop square Irons of the same piece proceeding from them, and standing out as far as *g g*, These Irons are so let into each other, that they comply and run Range with the square Sholders at both ends, wherein square Holes are made at the ends of the *Hose*. They are Screwed together with two small Screws, as at *h h*.

The

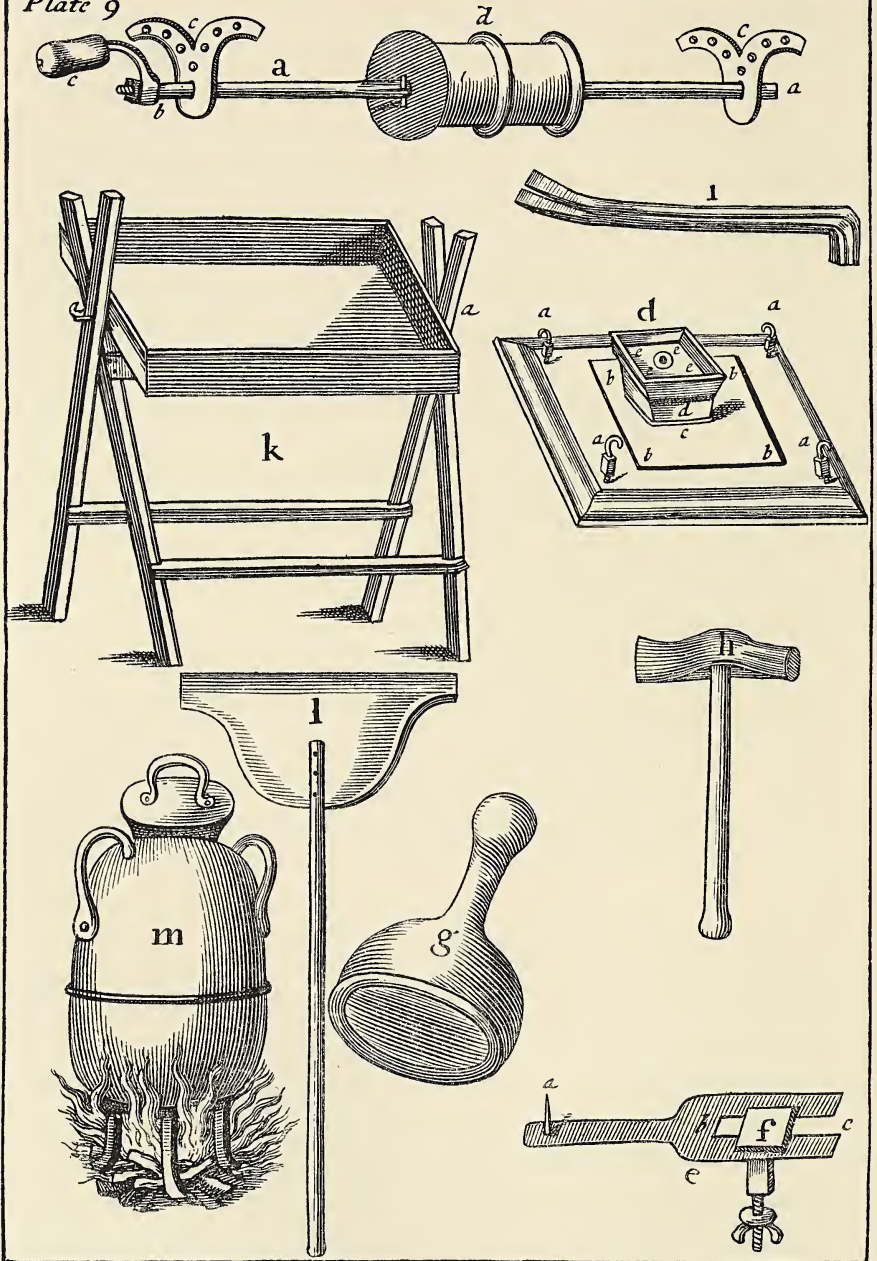
The four *Hofe-Hooks* are marked *i i i i*, They proceed from two Branches of an Iron Hoop at *k* encompassing the lower-end of the *Spindle*, on either Corner of the Branch, and have notches filled in their outer-fides as in the Figure, which notches are to contain feveral Turns of *Whip-cord* in each notch, which *Whip-cord* being alfo faftned to the *Hooks* on the *Plattin*, holds the *Plattin* tight to the *Hooks* of the *Hofe*.

¶. 15. *Of the Ribs, and Cramp-Irons.*

The *Ribs* are delineated in Plate 8. at E, they are made of four-square Irons the length of the *Wooden-Ribs* and *End-Rails*, viz. Four Foot five Inches long, and three quarters of an Inch fquare, only one end is batter'd to about a quarter of an Inch thick, and about two Inches and an half broad, in which battering four or five holes are Punch't for the nailing it down to the *Hind-Rail* of the *Wooden-Ribs*. The Fore-end is alfo batter'd down as the Hind-end, but bound downwards to a fquare, that it may be nailed down on the outer-fide of the *Fore-Rail* of the *Wooden-Ribs*.

Into the bottom of thefe *Ribs*, within nine Inches of the middle, on either fide is made two Female-Duftails about three quarters of an Inch broad, and half a quarter of an Inch thick, which Female-Duftails have Male-Duftails as at *a a a a* fitted ftiff into them, about an Inch and three quarters long; and thefe Male-Duftails have an hole punched at either end, that when they are fitted into the Female-Duftails in the *Ribs*, they may in thefe Holes be Nailed down the firmer to the *Wooden-Ribs*. Thefe

Plate 9



These *Ribs* are to be between the upper and the under side exactly of an equal thickness, and both to lye exactly Horizontal in straight lines; For irregularities will both Mount and Sink the *Cramp-Irons*, and make them *Run* rumbling upon the *Ribs*.

The upper-sides of these *Ribs* must be purely Smooth-fil'd and Pollish'd, and the edges a little Bevil'd roundish away, that they may be somewhat Arching at the top; because then the *Cramp-Irons* *Run* more easily and ticklishly over them.

The *Cramp-Irons* are marked F in Plate 8. They are an Inch and an half long besides the Battering down at both ends as the *Ribs* were; They have three holes Punched in each Battering down, to Nail them to the *Planck* of the *Coffin*; They are about half an Inch deep, and one quarter and an half thick; their upper-sides are smoothed and rounded away as the *Ribs*.

¶. 16. *Of the Spindle for the Rounce, described in Plate 9. at a.*

The *Axis* or *Spindle* is a straight Bar of Iron about three quarters of an Inch square, and is about three Inches longer than the whole breadth of the Frame of the *Ribs*, viz. two Foot two Inches: The farther end of it is Filed to a round Pin (as at *a*) three quarters of an Inch long, and three quarters of an Inch in Diameter; the hither end is filed away to such another round Pin, but is two Inches and a quarter long (as at *b*); at an Inch and a quarter from this end is Filed a Square Pin three quarters of an Inch long, and
with-

within half an Inch of the end is Filed another round Pin, which hath another Male-Screw on it, to which is fitted a fquare Iron *Nut* with a Female-Screw in it.

On the Square Pin is fitted a *Winch* fomewhat in form like a Jack-winch, but much ftronger; the *Eye* of which is fitted upon the Square aforefaid, and Screwed up tight with a Female-Screw. On the ftraight Shank of this Winch is fitted the *Rounce*, marked *e*.

The round ends of this *Axis* are hung up in two Iron-Sockets (as at *c c*) faftned with Nails (but more properly with Screws) on the outside the Wooden Frame of the *Ribs*.

The *Girt-Barrel* marked *d* is Turned of a Piece of Maple or Alder-wood, of fuch a length, that it may play eafily between the two Wooden *Ribs*; and of fuch a diameter, that in one revolution of it, fuch a length of *Girt* may wind about it as fhall be equal to half the length contained between the fore-end Iron of the *Tympan*, and the infide of the Rail of the *Inner-Tympan*; becaufe two Revolutions of this *Barrel* muft move the *Carriage* this length of fpace.

This *Barrel* is fitted and faftned upon the Iron *Axis*, at fuch a diftance from either end, that it may move round between the Wooden *Ribs* aforefaid.

¶. 17. Of the Prefs-Stone.

The *Prefs-Stone* fhould be Marble, though fometimes Mafter *Printers* make fhift with Purbeck, either becaufe they can buy them cheaper, or elfe becaufe they can neither diftinguifh them by their appearance, or know their different worths.

Its thicknefs muft be all the way throughout equal

qual, and ought to be within one half quarter of an Inch the depth of the inside of the *Coffin*; because the matter it is *Bedded* in will raise it high enough. Its length and breadth must be about half an Inch less than the length and breadth of the inside of the *Coffin*: Because *Justifiers* of Wood, the length of every side, and almost the depth of the *Stone*, must be thrust between the insides of the *Coffin* and the outsides of the *Stone*, to Wedge it tight and steady in its place, after the *Press-man* has *Bedded* it. Its upper-side, or Face must be exactly straight and smooth.

I have given you this description of the *Press-Stone*, because they are thus generally used in all *Printing-Houses*: But I have had so much trouble, charge and vexation with the often breaking of *Stones*, either through the carelessness or unskilfulness (or both) of *Press-men*, that necessity compell'd me to consider how I might leave them off; and now by long experience I have found, that a piece of *Lignum-vitæ* of the same size, and truly wrought, performs the office of a *Stone* in all respects as well as a *Stone*, and eases my mind, of the trouble, charge and vexation aforesaid, though the first cost of it be greater.

¶. 18. *Of the Plattin marked d in Plate 9.*

The *Plattin* is commonly made of Beechen-Planck, two Inches and an half thick, its length about fourteen Inches, and its breadth about nine Inches. Its sides are Tryed Square, and the Face or under-side of the *Plattin* Plained exactly straight and smooth. Near the four Corners on the upper-side, it hath
four

four Iron *Hooks* as at *a a a a*, whose Shanks are Wormed in.

In the middle of the upper-side is let in and fastened an Iron Plate called the *Plattin-Plate*, as *b b b b*, a quarter of an Inch thick, six Inches long, and four Inches broad; in the middle of this Plate is made a square Iron Frame about half an Inch high, and half an Inch broad, as at *c*. Into this square Frame is fitted the *Stud* of the *Plattin Pan*, so as it may stand steddy, and yet to be taken out and put in as occasion may require.

The *Stud* marked *d*, is about an Inch thick, and then spreads wider and wider to the top (at *e e e e*) of it, till it becomes about two Inches and an half wide; and the sides of this spreading being but about half a quarter of an Inch thick makes the *Pan*. In the middle of the bottom of this *Pan* is a small Center hole Punch'd for the *Toe* of the *Spindle* to work in.

§. 19. *Of the Points and Point-Screws.*

The Points are made of Iron Plates about the thickness of a Queen *Elizabeth* Shilling: It is delineated at *e* in Plate 9. which is sufficient to shew the shape of it, at the end of this Plate, as at *a*, stands upright the Point. This *Point* is made of a piece of small Wyer about a quarter and half quarter of an Inch high, and hath its lower end Filed away to a small Shank about twice the length of the thickness of the Plate; so that a Shoulder may remain. This small Shank is fitted into a small Hole made near the end of the Plate, and Revetted on the other side, as was taught

taught *Numb. 2. Fol. 24.* At the other end of the Plate is filed a long square notch in the Plate as at *b c* quarter and half quarter Inch wide, to receive the square shank of the *Point-Screws*.

The *Point-Screw* marked *f* is made of Iron; It hath a thin Head about an Inch square, And a square Shank juſt under the Head, an Inch deep, and almoſt quarter and half quarter Inch ſquare, that the ſquare Notch in the hinder end of the Plate may ſlide on it from end to end of the Notch; Under this ſquare Shank is a round Pin filed with a Male-Screw upon it, to which is fitted a *Nut* with a Female-Screw in it, and Ears on its out-side to twiſt about, and draw the Head of the Shank cloſe down to the *Tympan*, and ſo hold the *Point-Plate* faſt in its Place.

¶. 20. *Of the Hammer, deſcribed at h, and Sheeps-Foot deſcribed at i in Plate 9.*

The *Hammer* is a common *Hammer* about a quarter of a Pound weight; It hath no *Claws* but a *Pen*, which ſtands the *Preſs-man* inſtead when the *Chafe* proves ſo big, that he is forced to uſe ſmall *Quoins*.

The Figure of the *Sheeps-Foot* is deſcription ſufficient. Its uſe is to nail and un-nail the *Balls*.

The *Sheeps-Foot* is all made of Iron, with an Hammer-head at one end, to drive the *Ball-Nails* into the *Ball-Stocks*, and a Claw at the other end, to draw the *Ball-Nails* out of the *Ball-Stocks*.

¶. 21. *Of*

¶. 21. *Of the Foot-step, Girts, Stay of the Carriage, Stay of the Frisket, Ball-Stocks, Paper-Bench, Lye-Trough, Lye-Brush, Lye-Kettle, Tray to wet Paper in, Weights to Prefs Paper, Pelts, or Leather, Wool or Hair, Ball-Nails or Pumping-Nails.*

The *Foot-Step* is an Inch-Board about a Foot broad, and fixteen Inches long. This Board is nailed upon a piece of Timber about seven or eight Inches high, and is Bevil'd away on its upper-side, as is also the Board on its under-side at its hither end, that the Board may stand aslope upon the Floor. It is placed fast on the Floor under the Carriage of the Prefs. Its Office shall be shewed when we come to treat of Exercise of the *Prefs-man*.

Girts are Thongs of Leather, cut out of the Back of an Horse-hide, or a Bulls hide, sometimes an Hogs-hide. They are about an Inch and an half, or an Inch and three quarters broad. Two of them are used to carry the *Carriage* out and in. These two have each of them one of their ends nailed to the *Barrel* on the *Spindle* of the *Rounce*, and the other ends nailed to the *Barrel* behind the *Carriage* in the *Planck* of the *Coffin*, and to the *Barrel* on the fore-end of the *Frame* of the *Coffin*.

The *Stay* of the *Carriage* is sometimes a piece of the same *Girt* fastned to the outside of the further *Cheek*,
and

and to the further hinder side of the Frame of the *Carriage*. It is fastned at such a length by the *Press man*, that the *Carriage* may ride so far out, as that the Irons of the *Tympan* may just rise free and clear off the fore-side of the *Plattin*.

Another way to stay the *Carriage* is to let an Iron Pin into the upper-side of the further Rail of the Frame of the *Ribs*, just in the place where the further hinder Rail of the *Carriage* stands projecting over the *Rib-Rail*, when the Iron of the *Tympan* may just rise free from the Fore-side of the *Plattin*; for then that projecting will stop against the Iron Pin.

The *Stay* of the *Frisket* is made by fastning a Batten upon the middle of the Top-side of the *Cap*, and by fastning a Batten to the former Batten perpendicularly downwards, just at such a distance, that the upper-side of the *Frisket* may stop against it when it is turned up just a little beyond a Perpendicular. When a *Press* stands at a convenient distance from a Wall, that Wall performs the office of the aforesaid *Stay*.

Ball-Stocks are Turn'd of *Alder* or *Maple*. Their Shape is delineated in Plate 9. at g: They are about seven Inches in Diameter, and have their under side Turned hollow, to contain the greater quantity of *Wool* or *Hair*, to keep the *Ball-Leathers* plump the longer.

The *Lye-Trough* (delineated in Plate 9. at k) is a Square Trough made of Inch-Boards, about four Inches deep, two Foot four Inches long, and one Foot nine Inches broad, and flat in the Bottom. Its inside is Leaded with Sheet-Lead, which reaches up over the upper Edges of the *Trough*. In the middle of the two ends (for so I call the shortest sides) on the outer sides as *a a*, is fastned a round Iron Pin, which
moves

moves in a round hole made in an Iron Stud with a fquare Sprig under it, to be drove and faftned into a *Wooden Horfe*, which *Horfe* I need not describe, becaufe in Plate aforefaid I have given you the Figure of it.

The *Paper-Bench* is only a common Bench about three Foot eight Inches long, one Foot eight Inches broad, and three Foot four Inches high.

The *Lye Brush* is made of *Hogs-Bristles* faftned into a Board with Brafs-Wyer, for durance fake: Its Board is commonly about nine Inches long, and four and an half Inches broad; and the length of the Bristles about three Inches.

To perform the Office of a *Lye-Kettle* (which commonly holds about three Gallons) the old-fafhion'd *Chafers* are moft commodious, as well becaufe they are more handy and manageable than *Kettles* with Bails, as alfo becaufe they keep *Lye* longer hot.

The *Tray to Wet Paper* in is only a common Butchers Tray, large enough to *Wet* the largeft *Paper* in.

The *Weight to Prefs Paper* with, is either Mettal, or Stone, flat on the Bottom, to ly fteddy on the *Paper-Board*: It muft be about 50 or 60 pound weight.

For *Pelts* or *Leather*, *Ball-Nails* or *Pumping-Nails*, *Wool* or *Hair*, *Vellom* or *Parchment* or *Forrel*, the *Prefs-man* generally eafes the *Master-Printer* of the trouble of choofing, though not the charge of paying for them: And for *Paffe*, *Sallad Oyl*, and fuch accidental Requisites as the *Prefs-man* in his work may want, the *Devil* commonly fetches for him.

¶. 22. *Of Racks to Hang Paper on, and of the Peel.*

Our *Master-Printer* muft provide *Racks* to hang *Paper* on to *Dry*. They are made of Deal-board Battens, fquare,

square, an Inch thick, and an Inch and an half deep, and the length the whole length of the Deal, which is commonly about ten or eleven Foot long, or else so long as the convenience of the Room will allow: The two upper corners of these *Rails* are rounded off that they may not mark the *Paper*.

These *Racks* are Hung over Head, either in the *Printing-House*, or *Ware-house*, or both, or any other Room that is most convenient to *Dry Paper* in; they are hung a-thwart two *Rails* an Inch thick, and about three or four Inches deep, which *Rails* are fastned to some Joysts or other Timber in the Ceiling by Stiles perpendicular to the Ceiling; These *Rails* stand so wide assunder, that each end of the *Racks* may hang beyond them about the distance of two Foot, and have on their upper edge at ten Inches distance from one another, so many square Notches cut into them as the whole length of the *Rail* will bear; Into these square notches the *Racks* are laid parallel to each other with the flat side downwards, and the Rounded off side upwards.

The *Peel* is described in Plate 9. at 1, which Figure sufficiently shews what it is; And therefore I shall need say no more to it, only its Handle may be longer or shorter according as the height of the Room it is to be used in may require.

¶. 23. Of Inck.

The providing of good *Inck*, or rather good *Var-nish* for *Inck*, is none of the least incumbent cares upon our *Master-Printer*, though Custom has almost made it so here in *England*; for the process of making *Inck* being as well laborious to the Body, as noy-
fom

ſom and ungrateful to the Sence, and by ſeveral odd accidents dangerous of Firing the Place it is made in, Our *Engliſh Maſter-Printers* do generally diſcharge themſelves of that trouble; and inſtead of having good *Inck*, content themſelves that they pay an *Inck-maker* for good *Inck*, which may yet be better or worſe according to the Conſcience of the *Inck-maker*.

That our Neighbours the *Hollanders* who exhibit Patterns of good *Printing* to all the World, are careful and induſtrious in all the circumſtances of good *Printing*, is very notorious to all Book-men; yet ſhould they content themſelves with ſuch *Inck* as we do, their Work would appear notwithstanding the other circumſtances they obſerve, far leſs graceful than it does, as well as ours would appear more beautiful if we uſed ſuch *Inck* as they do: for there is many Reaſons, conſidering how the *Inck* is made with us and with them, why their *Inck* muſt needs be better than ours. As *Fiſt*, They make theirs all of good old *Linſeed-Oyl* alone, and perhaps a little *Roſin* in it ſometimes, when as our *Inck-makers* to ſave charges mingle many times *Trane-Oyl* among theirs, and a great deal of *Roſin*; which *Trane-Oyl* by its groſſneſs, Furs and Choaks up a *Form*, and by its fatneſs hinders the *Inck* from drying; ſo that when the Work comes to the *Binders*, it *Sets off*; and beſides is dull, ſmeary and unpleaſant to the Eye. And the *Roſin* if too great a quantity be put in, and the *Form* be not very *Lean Beaten*, makes the *Inck* turn yellow: And the ſame does New *Linſeed-Oyl*.

Secondly, They ſeldom *Boyl* or *Burn* it to that conſiſtence the *Hollanders* do, becauſe they not only ſave labour and Fewel, but have a greater weight of *Inck*
out

out of the same quantity of *Oyl* when less *Burnt* away than when more *Burnt* away; which want of Burning makes the *Inck* also, though made of good old *Linsfeed Oyl* Fat and Smeary, and hinders its *Drying*; so that when it comes to the *Binders* it also *Sets off*.

Thirdly, They do not use that way of clearing their *Inck* the *Hollanders* do, or indeed any other way than meer Burning it, whereby the *Inck* remains more *Oily* and *Greasie* than if it were well clarified.

Fourthly, They to save the *Press-man* the labour of *Rubbing* the *Blackening* into *Varnish* on the *Inck-Block*, *Boyl* the *Blackening* in the *Varnish*, or at least put the *Blackening* in whilst the *Varnish* is yet *Boiling-hot*, which so *Burns* and *Rubifies* the *Blackening*, that it loses much of its brisk and vivid black complexion.

Fifthly, Because *Blackening* is dear, and adds little to the weight of *Inck*, they stint themselves to a quantity which they exceed not; so that sometimes the *Inck* proves so unsufferable *Pale*, that the *Press-man* is forc'd to *Rub* in more *Blackening* upon the *Block*; yet this he is often so loth to do, that he will rather hazard the content the Colour shall give, than take the pains to amend it: satisfying himself that he can lay the blame upon the *Inck-maker*.

Having thus hinted at the difference between the *Dutch* and *English Inck*, I shall now give you the Receipt and manner of making the *Dutch-Varnish*.

They provide a *Kettle* or a *Caldron*, but a *Caldron* is more proper, such an one as is described in Plate 9. at m. This Vessel should hold twice so much *Oyl* as they intend to *Boyl*, that the *Scum* may be some considerable time a *Rising* from the top of the *Oyl* to the top of the Vessel to prevent danger. This *Cal-*
dron

dron hath a Copper Cover to fit the Mouth of it, and this Cover hath an Handle at the top of it to take it off and put it on by. This *Caldron* is fet upon a good ftrong Iron *Trevet*, and fill'd half full of old *Linfeed-Oyl*, the older the better, and hath a good Fire made under it of folid matter, either *Sea Coal*, *Charcoal* or pretty big Chumps of Wood that will burn well without much Flame; for fhould the Flame rife too high, and the *Oyl* be very hot at the taking off the Cover of the *Caldron*, the fume of the *Oyl* might be apt to take Fire at the Flame, and endanger the lofs of the *Oyl* and Firing the Houfe: Thus they let *Oyl* heat in the *Caldron* till they think it is Boyling-hot; which to know, they peel the outer Films of an *Oynion* off it, and prick the *Oynion* faft upon the end of a fmall long Stick, and fo put it into the heating *Oyl*: If it be Boyling-hot, or almoft Boyling-hot, the *Oynion* will put the *Oyl* into a Fermentation, fo that a Scum will gather on the top of the *Oyl*, and rife by degrees, and that more or lefs according as it is more or lefs Hot: But if it be fo very Hot that the Scum rife apace, they quickly take the *Oynion* out, and by degrees the Scum will fall. But if the *Oyl* be Hot enough, and they intend to put any *Rofin* in, the quantity is to every Gallon of *Oyl* half a Pound, or rarely a whole Pound. The *Rofin* they beat fmall in a *Mortar*, and with an Iron Ladle, or elfe by an Handful at a time ftrew it in gently into the *Oyl* left it make the Scum rife too faft; but every Ladle-full or Handful they put in fo leafurely after one another, that the firft muft be wholly diffolv'd before they put any more in; for elfe the Scum will Rife too faft, as aforefaid: So that
you

you may perceive a great care is to keep the Scum down: For if it Boyl over into the Fire never so little, the whole Body of *Oyl* will take Fire immediately.

If the *Oyl* be Hot enough to *Burn*, they *Burn* it, and that so often till it be *Hard* enough, which sometimes is six, seven, eight times, or more.

To *Burn* it they take a long small Stick, or double up half a Sheet of Paper, and light one end to set Fire to the *Oyl*; It will presently Take if the *Oyl* be Hot enough, if not, they Boyl it longer, till it be.

To try if it be *Hard* enough, they put the end of a Stick into the *Oyl*, which will lick up about three or four drops, which they put upon an Oyfter-shell, or some such thing, and set it by to cool, and when it is cold they touch it with their Fore or Middle-Finger and Thumb, and try its consistence by sticking together of their Finger and Thumb; for if it draw stiff like strong *Turpentine* it is *Hard* enough, if not, they Boyl it longer, or *Burn* it again till it be so consolidated.

When it is well Boyled they throw in an Ounce of Letharge of Silver to every four Gallons of *Oyl* to Clarifie it, and Boyl it gently once again, and then take it off the Fire to stand and cool, and when it is cool enough to put their Hand in, they Strain it through a Linnen Cloath, and with their Hands wring all the *Varnish* out into a Leaded Stone Pot or Pan, and keeping it covered, set it by for their use; The longer it stands by the better, because it is less subject to turn Yellow on the Paper that is Printed with it.

This is the *Dutch* way of making *Varnish*, and the way the English *Inck-makers* ought to use.

Note, First, That the *Varnish* may be made without *Burning* the *Oyl*, viz. only with well and long
Boyl-

Boyling it; for *Burning* is but a violent way of Boyling, to consolidate it the sooner.

Secondly, That an *Apple* or a *Crust* of *Bread*, &c. stuck upon the end of a Stick instead of an *Oynion* will also make the Scum of the *Oyl* rise: For it is only the Air contained in the Pores of the *Apple*, *Crust* or *Oynion*, &c. pressed or forced out by the violent heat of the *Oyl*, that raises the many Bubbles on the top of the *Oyl*: And the connection of those Bubbles are vulgarly called *Scum*.

Thirdly, The English *Inck-makers* that often make *Inck*, and that in great quantities, because one Man may serve all *England*, instead of setting a *Caldron* on a *Trevet*, build a *Furnace* under a great *Caldron*, and Trim it about so with Brick, that it Boils far sooner and more securely than on a *Trevet*; because if the *Oyl* should chance to Boil over, yet can it not run into the Fire, being Fenced round about with Brick as aforesaid, and the *Stoking-hole* lying far under the *Caldron*.

Fourthly, When for want of a *Caldron* the *Master-Printer* makes *Varnish* in a *Kettle*, He provides a great piece of thick *Canvass*, big enough when three or four double to cover the *Kettle*, and also to hang half round the sides of the *Kettle*: This *Canvass* (to make it more soluble) is wet in Water, and the Water well wrung out again, so that the *Canvass* remains only moist: Its use is to throw flat over the Mouth of the *Kettle* when the *Oyl* is *Burning*, to keep the smoak in, that it may stifle the Flame when they see cause to put it out. But the Water as was said before, must be very well wrung out of the *Canvass*, for should but a drop or two fall from the sides of it into the *Oyl* when it is *Burning*, it will so enrage the *Oyl*, and raise the Scum, that it might endanger the working over the top of the *Kettle*.

Having shewn you the *Master-Printers* Office, I account it suitable to proper Method, to let you know how the *Letter-Founder* Cuts the *Punches*, how the *Molds* are made, the *Matrices* Sunck, and the *Letter Cast* and *Drest*, for all these Operations precede the *Compositers* Trade, as the *Compositers* does the *Press-mans*; wherefore the next *Exercises* shall be (God willing) upon *Cutting* of the *Steel-Punches*. ME-

MECHANICK EXERCISES:

Or, the Doctrine of

Handy-works.

Applied to the Art of

Letter-Cutting.

P R E F A C E.

Letter-Cutting is a *Handy-Work* hitherto kept so conceal'd among the *Artificers* of it, that I cannot learn any one hath taught it any other; But every one that has used it, Learnt it of his own *Genuine Inclination*. Therefore, though I cannot (as in other Trades) describe the general *Practice* of *Work-men*, yet the *Rules* I follow I shall shew here, and have as good an *Opinion* of these *Rules*, as those have that are shyest of discovering theirs. For, indeed, by the appearance of some *Work* done, a judicious *Eye* may doubt whether they go by any *Rule* at all, though *Geometrick Rules*, in no *Practice* whatever, ought to be more nicely or exactly observed than in this.

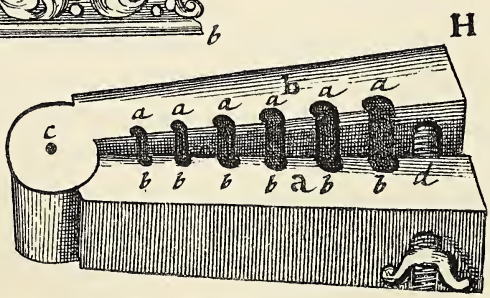
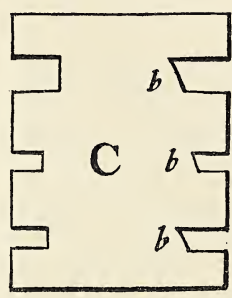
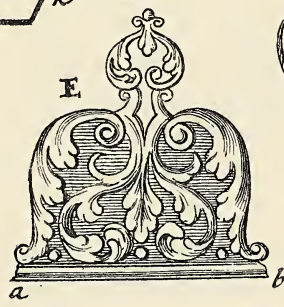
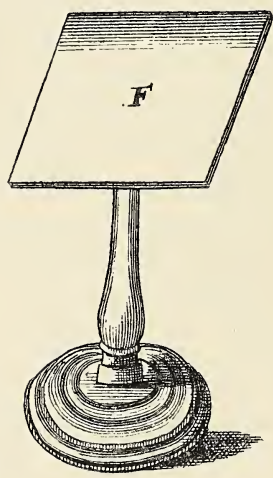
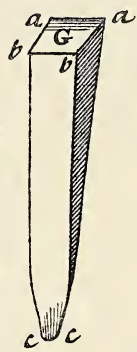
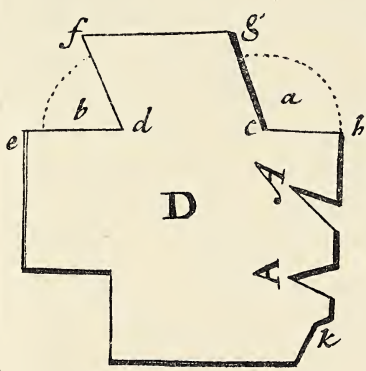
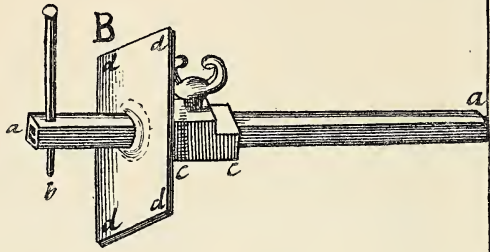
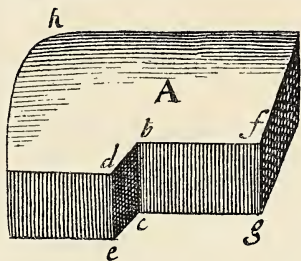
§ 12.

§. 12. ¶. 1. *Of Letter-Cutters Tools.*

THE making of *Steel Punches* is a Branch of the *Smith's Trade*: For, as I told you in the Preface to *Numb. 1.* The *Black-Smith's Trade* comprehends all Trades that use either Forge or File, from the *Anchor-Smith*, to the *Watch-maker*: They all working by the same Rules, though not with equal exactness; and all using the same Tools, though of different Sizes from those the Common *Black-Smith* uses; and that according to the various purposes they are applied, &c. Therefore, indeed, a *Letter-Cutter* should have a Forge set up, as by *Numb. 1.* But some *Letter-Cutters* may seem to scorn to use a Forge, as accounting it too hard Labour, and Ungenteel for themselves to officiate at. Yet they all well know, that though they may have a common *Black-Smith* perform their much and heavy Work, that many times a Forge of their own at Hand would be very commodious for them in several accidental little and light Jobs, which (in a Train of Work) they must meet withal.

But if our *Letter-Cutter* will have no Forge, yet he must of necessity accommodate himself with a *Vice*, *Hand-Vice*, *Hammers*, *Files*, *Small* and *Fine Files* (commonly called *Watch-makers Files*) of these he saves all, as they wear out, to smooth and burnish the Sides and Face of his Letter with, as shall be shewed; *Gravers*, and *Sculpters* of all sorts, an *Anvil*, or a *Stake*, an *Oyl-stone*, &c. And of these, such as are fuitable and fizable to the several Letters
he

Plate 10



he is to Cut. These, or many of these Tools, being described in *Numb. 1.* I refer my Reader thither, and proceed to give an account of some Tools peculiar to the *Letter-Cutter*, though not of particular use to the Common *Black-Smith*.

¶. 2. *Of the Ufing-File.*

This *File* is about nine or ten Inches long, and three or four Inches broad, and three quarters of an Inch thick: The two broad sides must be exactly flat and straight: And the one side is commonly cut with a *Bastard-Cut*, the other with a *Fine* or *Smooth Cut*. (See *Numb. 1. Fol. 14, 15.*) Its use is to *Rub* a piece of Steel, Iron, or Brass, &c. flat and straight upon, as shall be shewed hereafter.

In chusing it, you must see it be exactly Flat and Straight all its Length and Breadth: For if it in any part Belly out, or be Hollow inwards, what is Rubbed upon it will be Hollow, Rubbing on the Bellying part; and Bellying, Rubbing on the Hollow part. You must also see that it be very Hard; and therefore the thickest *Ufing-Files* are likeliest to prove best, because the thin commonly Warp in Hardning.

¶. 3. *Of the Flat-Gage.*

The *Flat-Gage* is described in *Plate 10.* at A. It is made of a flat piece of Box, or other Hard Wood. Its Length is three Inches and an half, its Breadth two Inches and an half, and its Thickness one Inch and
an

an half. This is on the Flat, firſt made Square, but afterwards hath one of its Corners (as *h*) a little rounded off, that it may the eaſier comply with the Ball of the Hand. Out of one of its longeſt Sides, *viz.* that not rounded off, is Cut through the thickneſs of it an exact Square, whoſe one ſide *b f*, *c g* is about an Inch and three quarters long; and its other ſide *b d*, *c e* about half an Inch long. The Depth of theſe Sides and their Angle is exactly Square to the top and bottom of the upper and under Surfaces of the *Flat-Gage*.

Its Uſe is to hold a Rod of Steel, or Body of a *Mold*, &c. exactly perpendicular to the Flat of the *Uſing-File*, that the end of it may rub upon the *Uſing-File*, and be Filed away exactly Square, and that to the Shank; as ſhall more at large be ſhewed in §. 2. ¶. 3.

¶. 4. Of the Sliding Gage.

The *Sliding Gage* is deſcribed in *Plate 10.* at *Fig. B.* It is a Tool commonly uſed by *Mathematical Instrument-Makers*, and I have found it of great uſe in *Letter-Cutting*, and making of *Molds*, &c. *a a* the Beam, *b* the Tooth, *c c* the Sliding Socket, *d d d d* the Shoulder of the Socket.

Its Uſe is to meaſure and ſet off Diſtances between the Shoulder and the Tooth, and to mark it off from the end, or elſe from the edge of your Work.

I always uſe two or three of theſe *Gages*, that I need not remove the Shoulder when it is ſet to a Diſtance which I may have after-uſe for; as ſhall in Working be ſhewed more fully.

¶. 5. *Of the Face-Gages, marked C in Plate 10.*

The *Face-Gage* is a Square Notch cut with a File into the edge of a thin Plate of Steel, Iron, or Brass, the thickness of a piece of common Latton, and the Notch about an *English* deep. There be three of these Gages made, for the Letters to be cut on one Body; but they may be all made upon one thin Plate, the readier to be found, as at D. As first, for the Long Letters; Secondly, for the Affending Letters; And Thirdly, for the Short Letters. The Length of these several Notches, or Gages, have their Proportions to the Body they are cut to, and are as follows. We shall imagine (for in Practice it cannot well be perform'd, unless in very large Bodies) that the Length of the whole Body is divided into forty and two equal Parts.

The *Gage* for the Long Letters are the length of the whole Body, *viz.* forty and two equal Parts. The *Gage* for the Affending Letters, *Roman* and *Italica*, are five Seventh Parts of the Body, *viz.* thirty Parts of Forty two, and thirty and three Parts for *English* Face. The *Gage* for the Short Letters are three Seventh Parts of the whole Body, *viz.* eighteen Parts of Forty two for the *Roman* and *Italica*, and twenty two Parts for the *English* Face.

It may indeed be thought impossible to divide a Body into seven equal Parts, and much more difficult to divide each of those seven equal Parts into fix equal Parts, which are Forty two, as aforesaid, especially if the Body be but small; but yet it is possible

possible with curious Working: For seven thin Spaces may be Cast and Rubb'd to do it. And for dividing each of the thin Spaces into six equal Parts, you may Cast and Rub Full Point . to be of the thickness of one thin Space, and one sixth part of a thin Space: And you may Cast and Rub : to be the thickness of one thin Space, and two sixth parts of a thin Space: And you may Cast and Rub , to be the thickness of one thin Space, and three sixth parts of a thin Space: And you may Cast and Rub - to be the thickness of one thin Space, and four sixth parts of a thin Space: And you may Cast and Rub ; to be the thickness of one thin Space, and five sixth parts of a thin Space.

The reason why I propose . to be Cast and Rubb'd one sixth part thicker than a thin Space, is only that it may be readily distinguished from : , - ; which are two sixth parts, three sixth parts, four sixth parts, five sixth parts thicker than a thin Space. And for six sixth parts thicker than a thin Space, two thin Spaces does it.

The manner of adjusting these several Sixth Parts of Thicknesses is as follows. You may try if six . exactly agree, and be even with seven thin Spaces; (or, which is all one, a Body) for then is each of those six . one sixth part thicker than a thin Space, because it drives out a thin Space in six thin Spaces. And you may try if six : be equal to a Body and one thin Space; for then is each : two sixth parts thicker than a thin Space. If six , be equal to nine thin Spaces, then each , is three sixth parts of a thin Space thicker than a thin Space. If six -
be

be equal to ten thin Spaces, then each - is four sixth parts of a thin Space thicker than a thin Space. If six ; be equal to eleven thin Spaces, then each ; is five sixth parts of a thin Space thicker than a thin Space.

Now, as aforesaid, a thin Space being one seventh part of the Body, and the thin Space thus divided, you have the whole Body actually divided into forty and two equal parts, as I have divided them in my Drafts of Letters down the Sides, and in the Bottom Line.

Though I have thus shewed how to divide a thin Space into six equal Parts, yet when the Letter to be Cut proves of a small Body, the thin Space divided into two equal Parts may serve: If it prove bigger, into three or four equal Parts: And of the largest Bodies, they may be divided into six, as aforesaid.

If now you would make a *Gage* for any number of thin Spaces and Sixth Parts of a thin Space, you must take one thin Space less than the number of thin Spaces proposed, and add . : , - ; according as the number of sixth Parts of a thin Space require; and to those complicated Thicknesses you may file a square Notch on the edge of the thin Plate aforesaid, which shall be a standing Gage or Measure for that number of thin Spaces and sixth Parts of a thin Space.

All the Exception against this way of Measuring is, that thin Spaces cast in Metal may be subject to bow, and so their Thicknesses may prove deceitful. But, in Answer to that, I say, you may, if you will,
Cast

Caft I for two thin Spaces thick, e for three thin Spaces thick, S for four thin Spaces thick, L for five thin Spaces thick, D for fix thin Spaces thick, or any other Letters near thefe feveral Thickneffes, as you think fit; only remember, or rather, make a Table of the number of thin Spaces that each Letter on the Shank is Caft for. And by complicating the Letters and Points, as aforefaid, you will have any Thicknefs, either to make a Gage by, or to ufe otherwife.

On the other Edge of the *Face-Gage* you may file three other Notches, of the fame Width with thofe on the former Edge, for the Long, the Affending, and Short Letters. But though the two fides of each of thefe Notches are parallel to each other, yet is not the third fide fquare to them, but hath the fame Slope the *Italick* hath from the *Roman*; as you may fee in the Figure at *b b b*.

¶ 6. Of Italick, and other Standing Gages.

Thefe *Gages* are to meafure (as aforefaid) the Slope of the *Italick* Stems, by applying the Top and Bottom of the *Gage* to the Top and Bottom Lines of the Letters, and the other Side of the *Gage* to the Stem: for when the Letter complies with thefe three fides of the *Gage* that Letter hath its true Slope.

The manner of making thefe *Gages* (and indeed all other *Angular Gages*) is thus.

Place one Point of a Pair of Steel *Dividers* upon the thin Plate aforefaid, at the Point *c* or *d* (in Fig.

Fig. D in Plate 10.) and with the other Point describe a small fine Arch of a Circle; as, *e f* or *g h*. In this Arch of the Circle must be set off on the *Gage a* 110 Degrees, and on the *Gage b* 70 Degrees, and draw from the Centres *c* and *d* two straight Lines through those numbers of Degrees: Then Filing away the Plate between the two Lines, the *Gages* are finished.

To find the Measure of this, or any other number of Degrees, do thus; Describe a Circle on a piece of Plate-Brass of any Radius (but the larger the better) draw a straight Line exactly through the Centre of this Circle, and another straight Line to cut this straight Line at right Angles in the Centre, through the Circle; so shall the Circle be divided into four Quadrants: Then fix one Foot of your Compasses (being yet unstirr'd) in one of the Points where any of the straight Lines cuts the Circle, and extend the moving Foot of your Compasses where it will fall in the Circle, and make there a Mark, which is 60 Degrees from the fixed Foot of the Compasses: Then fix again one Foot of your Compasses in the Intersection of the straight Line and Circle that is next the Mark that was made before, and extend the moving Foot in the same Quadrant towards the straight Line where you first pitch'd the Foot of your Compasses, and with the moving Foot make another Mark in the Circle. These two Marks divide the Quadrant into three equal Parts: The same way you may divide the other three Quadrants; so shall the whole Circle be divided into twelve equal Parts; and each of these twelve equal parts contain

tain an Arch of thirty Degrees: Then with your Dividers divide each of these 30 Degrees into three equal Parts, and each of these three equal Parts into two equal Parts, and each of these two equal Parts into five equal Parts, so shall the Circle be divided into 360 equal Parts, for your use.

To use it, describe on the Centre of the Circle an Arch of almost a Semi-Circle: This Arch must be exactly of the same Radius with that I prescribed to be made on the *Gages a b*, from *e* to *f*, and from *g* to *h*; then count in your Circle of Degrees from any Diametral Line 110 Degrees; and laying a straight Ruler on the Centre, and on the 110 Degrees aforesaid, make a small Mark through the small Arch; and placing one Foot of your Compasses at the Intersection of the small Arch, with the Diametral Line, open the other Foot to the Mark made on the small Arch for 110 Degrees, and transfer that Distance to the small Arch made on the *Gage*: Then through the Marks that the two Points of your Compasses make in the small Arch on the *Gage*, draw two straight Lines from the Centre *c*: and the Brass between those two straight Lines being filed away, that *Gage* is made. In like manner you may set off any other number of Degrees, for the making of any other *Gage*.

In like manner, you may measure any Angle in the Drafts of Letters, by describing a small Arch on the Angular Point, and an Arch of the same Radius on the Centre of your divided Circle: For then, placing one Foot of your Compasses at the Intersection of the small Arch with either of the straight
Lines

Lines proceeding from the Angle in the Draft, and extending the other Foot to the Interfection of the small Arch, with the other straight Line that proceeds from the Angle, you have between the Feet of your Compasses, the Width of the Angle; and by placing one Foot of your Compasses at the Interfection of any of the straight Lines that proceed from the Centre of the divided Circle, and the small Arch you made on it, and making a Mark where the other Foot of your Compasses falls in the said small Arch, you may, by a straight Ruler laid on the Centre of the divided Circle, and the Mark on the small Arch, see in the Limb of the Circle the number of Degrees contained between the Diametral, or straight Line and the Mark.

If you have already a dividing-Plate of 360 Degrees, of a larger Radius than the Arch on your *Gage*, you may save your self the labour of dividing a Circle (as aforesaid,) and work by your dividing-Plate as you were directed to do with the Circle that I shewed you to divide.

In these Documents I have exposed my self to a double Censure; First, of *Geometricians*: Secondly, of *Letter-Cutters*. *Geometricians* will censure me for writing anew that which almost every young Beginner knows: And *Letter-Cutters* will censure me for proposing a Rule for that which they dare pretend they can do without Rule.

To the *Geometricians* I cross the Cudgels: yet I writ this not to them; and I doubt I have written superfluously to *Letter-Cutters*, because I think few of them either will or care to take pains to understand
these

theſe ſmall Rudiments of *Geometry*. If they do, and be ingenious, they will thank me for diſcovering this Help in their own Way, which few of them know. For by this Rule they will not only make Letters truer, but alſo quicker, and with leſs care; becauſe they ſhall never need to ſtamp their *Counter-Punch* in Lead, to ſee how it pleaſes them; which they do many times, before they like their *Counter-Punch*, (be it of A *A* V v W w *V* *W*, and ſeveral other Letters) and at laſt finiſh their *Counter-Punch* but with a good Opinion they have that it may do well, though they frequently ſee it does not in many Angular Letters on different Bodies Cut by the ſame Hand. And were *Letter-Cutting* brought to ſo common Practice as *Joynery*, *Cabinet-making*, or *Mathematical Inſtrument-making*, every young Beginner ſhould then be taught by Rules, as they of theſe Trades are; becauſe *Letter-Cutting* depends as much upon Rule and Compaſs as any other Trade does.

You may in other places, where you find moſt Convenience (as at *i*) make a Square, which may ſtand you in ſtead for the Squaring the Face and Stems of the *Punch* in *Roman* Letters, and alſo in many other Uſes.

And you may make *Gages*, as you were taught before to try the *Counter-Punches* of Angular Letters; as, A K M N V X Y Z, *Romans* and *Italicks*, *Capitals* and *Lower-Caſe*. But then, that you may know each diſtinct *Gage*, you may engrave on the ſeveral reſpective *Gages*, at the Angle, A *A* 4 &c. For by examining by the Drafts of Letters, what Angle their Infides make, you may ſet that Angle off, and
make

make the *Gage* as you were taught before, in the *Gage* for the Slope of *Italicks*.

¶. 7. *Of the Liner.*

The *Liner* is marked E in *Plate 10*. It is a thin Plate of Iron or Brass, whose Draft is sufficient to express the Shape. The Use of it is on the under-edge *a b* (which is about three Inches long) and is made truly straight, and pretty sharp or fine; that being applied to the Face of a *Punch*, or other piece of Work, it may shew whether it be straight or no.

¶. 8. *Of the Flat-Table.*

The *Flat-Table* at F in *Plate 10*. The Figure is there sufficient. All its Use is the Table F, for that is about one Inch and an half square, and on its Superficies exactly straight and flat. It is made of Iron or Brass, but Brass most proper. Its Use is to try if the Shank of a *Punch* be exactly Perpendicular to its Face, when the Face is set upon the *Table*; for if the Shank stand then directly upright to the Face of the *Table*, and lean not to any side of it, it is concluded to be perpendicular.

It hath several other Uses, which, when we come to *CASTING of Letters*, and *JUSTIFYING of Matrices*, shall be shewn.

¶. 9.

¶. 9. *Of the Tach.*

The *Tach* is a piece of Hard-Wood, (Box is very good) about three Inches broad, six Inches long, and three quarters of an Inch thick. About half its Length is fastned firm down upon the *Work-Bench*, and its other half projects over the hither Edge of it. It hath three or four Angular Notches on its Fore-end to rest and hold the Shank of a *Punch* steady when the End of the *Punch* is screwed in the *Hand-Vice*, and the *Hand-Vice* held in the Left Hand, while the *Work-man* Files or Graves on it with his Right Hand.

Instead of Fastning the *Tach* to the *Bench*, I Saw a square piece out of the further half of the *Tach*, that it may not be too wide for the Chaps of the *Vice* to take and screw that narrow End into the Chaps of the *Vice*, because it should be less cumbersome to my *Work-Bench*.

¶. 10. *Of Furnishing the Work-Bench.*

The *Work-man* hath all his great *Files* placed in Leather Nooses, with their Handles upwards, that he may readily distinguish the *File* he wants from another *File*. These Nooses are nailed on a Board that Cafes the Wall on his Right Hand, and as near his *Vice* as Convenience will admit, that he may the readier take any *File* he wants.

He hath also on his Right Hand a Tin Pot, of about a Pint, with small *Files* standing in it, with
their

their Handles downwards, that their Blades may be the readier seen. These small *Files* are called *Watch-makers Files*, and the *Letter-Cutter* hath occasion to use these of all Shapes, viz. *Flat, Pillar, Square, Triangular, Round, Half-Round, Knife-Files, &c.*

He also provides a shallow square Box, of about five Inches long, and three Inches broad, to lay his small Instruments in; as, his *Gages*, his *Liner*, some common *Punches*, &c. This Box he places before him, at the further side of the *Work-Bench*.

He also provides a good *Oyl-Stone*, to sharpen his *Gravers* and *Sculpters* on. This he places at some distance from the *Vice*, on his Left Hand.

§. 13. ¶. 1. Of Letter-Cutting.

The *Letter-Cutter* does either Forge his *Steel-Punches*, or procures them to be forged; as I shewed, Numb. 1. Fol. 8, 9, 10. in Vol. I. &c. But great care must be taken, that the Steel be sound, and free from Veins of Iron, Cracks and Flaws, which may be discerned; as I shewed in Numb. 3. Vol. I. For if there be any Veins of Iron in the Steel, when the Letter is Cut and Temper'd, and you would Sink the *Punch* into the Copper, it will batter there: Or it will Crack or Break if there be Flaws.

If there be Iron in it, it must with the Chissel be split upon a good Blood-Red-Heat in that place, and the Iron taken or wrought out; and then with another, or more Welding Heat, or Heats, well doubled up, and laboured together, till the Steel become a sound entire piece. This Operation *Smiths* call *Well Currying of the Steel*. If

If there be Flaws in it, you muſt alſo take good Welding Heats, ſo hot, that the contiguous ſides of the Flaws may almoſt Run: for then, ſnatching it quickly out of the Fire, you may labour it together till it become cloſe and found.

Mr. *Robinson*, a *Black-Smith* of *Oxford*, told me a way he uſes that is ingenious, and ſeems rational: For if he doubts the Steel may have ſome ſmall Flaws that he can ſcarce diſcern, he takes a good high Blood-Red Heat of it, and then twiſts the Rod or Bar (as I ſhewed, *Numb.* 3. *Vol.* I.) which Twiſting winds the Flaws about the Body of the Rod, and being thus equally diſpoſed, more or leſs, into the Out-ſides of the Rod, according as the Poſition of the Flaw may be, allows an equal Heat on all ſides to be taken, becauſe the Out-ſides heat faſter than the In-ſide; and therefore the Out-ſides of the Steel are not thus ſo ſubject to Burn, or Run, as if it ſhould be kept in the Fire till the Middle, or In-ſide of it ſhould be ready to Run. And when the Steel is thus well welded, and foundly laboured and wrought together with proper Heats, he afterwards reduces it to Form.

Now, that I may be the better underſtood by my Reader as he reads further, I have, in *Plate* 10. at *Fig.* G deſcribed the ſeveral Parts of the *Punch*; which I here explain.

G The Face.

a a, *b b* The Thickneſs.

a b, *a b* The Heighth.

a c, *b c*, *b c* The Length of the Shank, about an Inch and three quarters long.

c c c The Hammer-End.

This

This is no strict Length for the Shank, but a convenient Length; for should the Letter Cut on the Face be small, and consequently, the Shank so too, and the Shank much longer, and it (as seldom it is) not Temper'd in the middle, it might, with Punching into Copper, bow in the middle, either with the weight of the Hammer, or with light reiterated Blows: And should it be much shorter, there might perhaps Finger-room be wanting to manage and command it while it is Punching into the Copper. But this Length is long enough for the biggest Letters, and short enough for the smallest Letters.

The Heighth and Thickness cannot be assign'd in general, because of the diversity of Bodies, and Thickness of Letters: Besides, some Letters must be Cut on a broad Face of Steel, though, when it is Cut, it is of the same Body; as all Letters are, to which *Counter-Punches* are used; because the Striking the *Counter-Punch* into the Face of the *Punch* will, if it have not strength enough to contain it, break or crack one or more sides of the *Punch*, and so spoil it. But if the Letter be wholly to be Cut, and not Counter-Punch'd, as I shall hereafter hint in general what Letters are not, then the Face of the *Punch* need be no bigger, or, at least, but a small matter bigger than the Letter that is to be cut upon it.

Now, If the Letter be to be Counter-punch'd, the Face of the *Punch* ought to be about twice the Heighth, and twice the Thickness of the Face of the *Counter-Punch*; that so, when the *Counter-Punch* is struck just on the middle of the Face of the *Punch*, a

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convenient Substance, and consequently, Strength of Steel on all its Sides may be contained to resist the Delitation, that the Sholder or Beard of the *Counter-Punch* sinking into it, would else make.

If the *Letter-Cutter* be to Cut a whole Set of *Punches* of the same Body of *Roman* and *Italica*, he provides about 240 or 260 of these *Punches*, because so many will be used in the *Roman* and *Italica Capitals* and *Lower-Case, Double-Letters, Swash-Letters, Accented Letters, Figures, Points, &c.* But this number of *Punches* are to have several Heighths and Thickneses, though the Letters to be Cut on them are all of the same Body.

What Heighth and Thickness is, I have shewed before in this §, but not what Body is; therefore I shall here explain it.

By Body is meant, in *Letter-Cutters, Founders* and *Printers* Language, the Side of the Space contained between the Top and Bottom Line of a Long Letter. As in the Draft of Letters, the divided Line on the Left Hand of A is divided into forty and two equal Parts; and that Length is the Body, thus: J being an Ascending and Descending Letter, *viz.* a long Letter, stands upon forty two Parts, and therefore fills the whole Body.

There is in common Use here in *England*, about eleven Bodies, as I shewed in §. 2. ¶. 2. of this Volume.

I told you even now, that all the *Punches* for the same Body must not have the same Heighth and Thickness: For some are Long; as, J j Q, and several others; as you may see in the Drafts of Letters: and these long Letters stand upon the whole Heighth of the Body.

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The Ascending and Descending Letters reach from the Foot-Line, up to the Top-Line; as all the Capital Letters are Ascending Letters, and so are many of the Lower-Case Letters; as, b d f, and several others. The Descending Letters are of the same Length with the Ascending Letters; as, g p q and several others. These are contained between the Head-Line and the Bottom-Line. The Short Letters are contained between the Head-Line and the Bottom-line. These are three different Sizes of Height the *Punches* are made to, for Letters of the same Body. But in proper place I shall handle this Subject more large and distinctly.

And as there is three Heights or Sizes to be considered in Letters Cut to the same Body, so is there three Sizes to be considered, with respect to the Thicknesses of all these Letters, when the *Punches* are to be Forged: For some are m thick; by m thick is meant m *Quadrat* thick, which is just so thick as the Body is high: Some are n thick; that is to say, n *Quadrat* thick, viz. half so thick as the Body is high: And some are *Space* thick; that is, one quarter so thick as the Body is high; though Spaces are seldom Cast so thick, as shall be shewed when we come to *Casting*: and therefore, for distinction sake, we shall call these Spaces, Thick Spaces.

The first three Sizes fit exactly in Height to all the Letters of the same Body; but the last three Sizes fit not exactly in Thickness to the Letters of the same Body; for that some few among the Capitals are more than m thick, some less than m thick, and more than n thick; and some less than n thick, and
more

more than Space thick; yet for Forging the *Punches*, these three Sizes are only in general Considered, with Exception had to *Æ* *Æ* *Q*, and most of the Swash Letters; which being too thick to stand on an m, must be Forged thicker, according to the Work-man's Reason.

After the Work-man has accounted the exact number of Letters he is to Cut for one Set, he considers what number he shall use of each of these several Sizes in the *Roman*, and of each of these several Sizes in the *Italick*; (for the *Punches* of *Romans* and *Italicks*, if the Body is large, are not to be Forged to the same shape, as shall be shewed by and by) and makes of a piece of Wood one Pattern of the several Sizes that he must have each number Forged to. Upon every one of these Wooden Patterns I use to write with a Pen and Ink the number of *Punches* to be Forged of that Size, lest afterwards I might be troubled with Recollections.

I say (for Example) He considers how many long Letters are m thick, how many long Letters are n thick, and how many long Letters are Space thick, in the *Roman*; and also considers which of these must be Counter-punch'd, and which not: For (as was said before) those Letters that are to be Counter-punch'd are to have about twice the Heighth and twice the Thicknes of the Face of the *Counter-Punch*, for the Reason aforesaid. But the Letters not to be Counter-punch'd need no more Substance but what will just contain the Face of the Letter; and makes of these three Sizes three Wooden Patterns, of the exact Length, Heighth and Thicknes that the Steel *Punches* are to be Forged to. He

He also counts how many are Ascendents and Descendents, m-thick, n-thick, and Space thick; still considering how many of them are to be Counter-punch'd, and how many not; and makes Wooden Patterns for them.

The like he does for short Letters; and makes Wooden Patterns for them, for Steel *Punches* to be Forged by.

And as he has made his Patterns for the *Roman*, so he makes Patterns for the *Italick* Letters also; for the same shap'd *Punches* will not serve for *Italick*, unless he should create a great deal more Work to himself than he need do: For *Italick Punches* are not all to be Forged with their sides square to one another, as the *Romans* are; but only the highest and lowest sides must stand in Line with the highest and lowest sides of the *Roman*; but the Right and Left Hand sides stand not parallel to the Stems of the *Roman*, but must make an Angle of 20 Degrees with the *Roman* Stems: so that the Figure of the Face of the *Punch* will become a *Rhomboides*, as it is called by *Geometricians*, and the Figure of this Face is the Slope that the *Italick* Letters have from the *Roman*, as in proper place shall be further shewed. Now, should the *Punches* for these Letters be Forged with each side square to one another, the *Letter-Cutter* would be forced to spend a great deal of Time, and take great pains to File away the superfluous Steel about the Face of the Letter when he comes to the Finishing of it, especially in great Bodied Letters. Yet are not all the *Italick* Letters to be Forged on the Slope; for the *Punches* of some of them, as the

m n,

m n, and many others, may have all, or, at leaft, three of their fides, fquare to one another, though their Stems have the common Slope, becaufe the ends of their Beaks and Tails lie in the fame, perpendicular with the Outer Points of the Bottom and Top of their Stems, as is fhewed in the Drafts of Letters.

Though I have treated thus much on the Forging of Punches, yet muft all what I have faid be understood only for great Bodied *Punches*; viz. from the *Great Primer*, and upwards. But for fmall Bodies; as *English*, and downwards, the *Letter-Cutter* generally, both for *Romans* and *Italicks*, gets fo many fquare Rods of Steel, Forged out of about two or three Foot in Length, as may ferve his purpofe; which Rods he elects as near his Body and Sizes as his Judgment will ferve him to do; and with the edge of a Half-round File, or a Cold-Chiffel, cuts them into fo many Lengths as he wants *Punches*. Nay, many of thefe Rods may ferve for fome of the fmall Letters in fome of the greater Bodies; and alfo, for many of their *Counter-Punches*.

Having thus prepared your *Punches*, you muft Neal them, as I fhewed in *Numb. 3. Vol. I.*

¶ 2. Of Counter-Punches.

The *Counter-Punches* for great Letters are to be Forged as the *Letter-Punches*; but for the fmall Letters, they may be cut out of Rods of Steel, as aforefaid. They muft alfo be well Neal'd, as the *Punches*. Then muft one of the ends be Filed away
on

on the out-side the Shank, to the exact shape of the in-side of the Letter you intend to Cut. For Example, If it be *A* you would Cut; This *Counter-Punch* is easie to make, because it is a Triangle; and by measuring the In-side of the Angle of *A* in the Draft of Letters, as you were taught, §. 12. ¶. 6. you may make on your Standing *Gage-Plate* a *Gage* for that Angle: So that, let the Letter to be Cut be of what Body you will, from the least, to the biggest Body, you have a Standing *Gage* for this *Counter-Punch*, so oft as you may have occasion to Cut *A*.

The *Counter-Punch* of *A* ought to be Forged Triangularly, especially towards the Punching End, and Tryed by the *A Gage*, as you were taught to use the Square, Numb. 3. Vol. I. Yet, for this and other Triangular *Punches*, I commonly reserve my worn out three square Files, and make my *Counter-Punch* of a piece of one of them that best fits the Body I am to Cut.

Having by your *A-Gage* fitted the Top-Angle and the Sides of this *Counter-Punch*, you must adjust its Height by one of the three *Face-Gages* mentioned in §. 12. ¶. 5. viz. by the Ascending *Face-Gage*; for *A* is an Ascending Letter. By Adjusting, I do not mean, you must make the *Counter-Punch* so high, as the Depth of the Ascending *Face-Gage*; because in this Letter here is to be considered the Top and the Footing, which strictly, as by the large Draft of *A*, make both together five sixth Parts of a thin Space: Therefore five sixth Parts must be abated in the Height of your *Counter-Punch*, and it must be but four thin Spaces, and one sixth part of a thin
Space

Space high, becaufe the Top above the *Counter-Punch*, and the Footing below, makes five fixth Parts of a thin Space, as aforefaid.

Therefore, to meafure off the Width of four thin Spaces and one fixth Part of a thin Space, lay three thin Spaces, or, which is better, the Letter *e*, which is three thin Spaces, as aforefaid; and . which is one thin Space and one fixth part of a thin Space, upon one another; for they make together, four thin Spaces, and one fixth part of a thin Space; and the thicknefs of thefe two Meafures fhall be the Heighth of the *Counter-Punch*, between the Footing and the Inner Angle of *A*. And thus, by this Example, you may couple with proper Meafures either the whole Forty two, which is the whole Body, or any number of its Parts, as I told you before.

This Measure of four thin Spaces and one fixth part of a thin Space is not a Measure, perhaps, ufed more in the whole Set of Letters to be Cut to the prefent Body, therefore you need not make a *Standing Gage* for it; yet a prefent *Gage* you muft have: Therefore ufe the *Sliding Gage* (defcribed in §. 12. ¶. 4. and *Plate* 10. at B.) and move the Socket *c c* on the Beam *a a*, till the Edge of the Sholder of the Square of the Socket at the under-fide of the Beam ftands juft the Width of four thin Spaces and one fixth part of a thin Space, from the Point of the Tooth *b*; which you may do by applying the Measure aforefaid juft to the Square and Point of the Tooth; for then if you Screw down the Screw in the upper fide of the Sliding Socket, it will faften the Square at that diftance from the Point of the
Tooth.

Tooth. And by again applying the side of the Square to the Foot of the Face of the *Counter-Punch*, you may with the Tooth describe a small race, which will be the exact Heighth of the *Counter-Punch* for *A*. But *A* hath a Fine stroak within it, reaching from Side to Side, which by the large Draft of *A*, you may find that the middle of this cross stroak is two Thin Spaces above the bottom of this *Counter-Punch*; and with your common *Sliding-Gage* measure that distance as before, and set off that distance also on the Face of your *Counter-Punch*. Then with the edge of a Fine *Knife-File*, File straight down in that race, about the depth of a Thin Space, or somewhat more; So shall the *Counter-Punch* for *A* be finisht. But you may if you will, take off the Edges or Sholder round about the Face of the *Counter-Punch*, almost so deep as you intend to strike it into the *Punch*: for then the Face of the *Counter-Punch* being Filed more to a Point, will easier enter the *Punch* than the broad Flat-Face.

But note, That if it be a very Small Bodied *A* you would make, the Edge of a Thin *Knife-File* may make too wide a Groove: In this case you must take a peece of a well-Temper'd broken Knife, and strike its Edge into the Face of the *Counter-Punch*, as aforefaid.

¶ 3. Of Sinking the Counter-Punches.

Having thus finisht his *Counter-Punch*, he Hardens and Tempers it, as was taught Numb. 3. fol. 57, 58. Vol. I. And having also Filed the Face of his Punch
he

he intends to cut his *A* upon, pretty Flat by guesſ, he Screws the Punch upright, and hard into the Vice: And ſetting the Face of his *Counter-Punch* as exactly as he can, on the middle of the Face of his Punch, he, with an Hammer ſuitable to the Size of his *Counter-Punch*, ſtrikes upon the end of the *Counter-Punch* till he have driven the Face of it about two Thin Spaces deep into the Face of the Punch. So ſhall the *Counter-Punch* have done its Office.

But if the Letter to be *Counter-Puncht* be large, as *Great Primmer*, or upwards, I take a good high Blood red Heat of it, and Screw it quickly into the Vice; And having my *Counter-Punch* Hard, not Temper'd, becauſe the Heat of the Punch ſoftens it too faſt: And alſo having before-hand the *Counter-Punch* Screwed into the *Hand-Vice* with its Shank along the Chaps, I place the Face of the *Counter-Punch* as before, on the middle of the Face of the Punch, and with an Hammer drive it in, as before.

Taking the Punch out of the Vice, he goes about to Flat and Smoothen the Face in earneſt; for it had been to no purpoſe to Flat and Smoothen it exactly before, becauſe the Sinking of the *Counter-Punch* into it, would have put it out of Flat again.

But before he Flats and Smoothenſ the Face of the Punch, He Files by guesſ the ſuperfluous Steel away about the Face of the Letter, *viz.* ſo much, or near ſo much, as is not to be uſed when he comes to finiſh up the Letter, as in this preſent Letter *A*, which ſtanding upon a Square Face on the Punch, meets in an Angle at the Top of the Letter. Therefore the Sides of that Square muſt be Filed away
to

to an Angle at the Top of the Face of the Punch. But great care must be taken, that he Files not more away than he should: For he considers that the left hand Stroak of *A* is a Fat Stroak, and that both the left-hand and the right-hand Stroak too, have Footings, which he is careful to leave Steel enough in their proper places for.

The reason why these are now Fil'd thus away, and not after the Letter is finish'd, is, Because in the Flatting the Face there is now a less Body of Steel to File away, than if the whole Face of the Punch had remain'd intire: For though the following ways are quick ways to Flatten the Face, yet considering how tenderly you go to Work, and with what Smooth Files this Work must be done, the riddance made will be far less when a broad Face of *Steel* is to be Flatned, than when only so much, or very little more than the Face of the *Letter* only is to be Flatned.

To Flat and Smoothen the Face of the Punch, he uses the *Flat-Gage*, (described §. 12. ¶. 3. and *Plate* 10. at A.) thus, He fits one convex corner of the Shank of the Punch, into the Concave corner of the *Flat-Gage*, and so applies his *Flat-Gage-Punch* and all to the Face of the *Ufing-File*, and lets the *Counter-Puncht* end, viz. the Face of the Punch Sink down to the Face of the *Ufing-File*: And then keeping the convex Corner of the Shank of the Punch close and steddly against the Concave corner of the *Flat-Gage*, and pressing with one of his Fingers upon the then upper end of the Punch, viz. the Hammer-end, he also at the same time, presses
the

the lower end of the Punch, *viz.* The Face againſt the *Uſing-File*, and thruſts the *Flat-Gage* and *Punch* in it ſo oft forwards, till the extuberant Steel on the Face, be Rub'd or Fil'd away: which he knows partly by the alteration of colour and Fine Furrows made by the *Uſing-File* on the Face of the Punch, and partly by the falling away of the parts of the Face that are not yet toucht by the *Uſing-File*: So that it may be ſaid to be truly Flat: which he knows, when the whole Face of the Punch touches upon the Flat of the *Uſing-File*, or at leaſt, ſo much of the Face as is required in the Letter: For all Counter-Puncht-Letters, as aforeſaid, muſt have a greater Face of Steel than what the bare Letter requires: for the reaſon aforeſaid.

Another way I uſe is thus. After I have Fil'd the Face as true as I can by gueſs, with a *Rough-Cut-File*, I put the Punch into an Hand-Vice, whoſe Chaps are exactly Flat, and ſtraight on the upper Face, and ſink the Shank of the Punch ſo low down in the Chaps of the Hand-Vice, that the low ſide of the Face of the Punch may lye in the ſame Plain with the Chaps; which I try with the Liner. For the Liner will then ſhew if any of the Sides ſtand higher than the Plain of the Chaps: Then I Screw the Punch hard up, and File off the riſing ſide of the Punch, which brings the Face to an exact Level: For the Face of the Chaps being Hard Steel, a File cannot touch them, but only take off the aforeſaid Riſing parts of the Face of the Punch, till the *Smooth-File* has wrought it all over exactly into the ſame Plain with the Face of the Chaps of the *Hand-Vice*.
Some

Some *Letter-Cutters* work them Flat by Hand, which is not only difficult, but tedious, and at the best, but done by guess.

The inconvenience that this Tool is subject to, is, That with much using its Face will work out of Flat. Therefore it becomes the Workman to examine it often, and when he finds it faulty to mend it.

When they *File* it Flat by Hand, they Screw the Shank of the Punch perpendicularly upright into the Chaps of the Vice, and with a *Flat-Bastard-Cut-File*, of about Four Inches long, or if the Punch be large, the File larger, according to discretion, and File upon the Face, as was shewn *Numb. I. fol. 15, 16.* Then they take it out of the Vice again, and holding up the Face Horizontally between the Sight and the Light, examine by nice observing whether none of its Angles or Sides are too high or too low. And then Screwing it in the Vice again, as before, with a *Smooth-Cut-File*, he at once both Files down the Higher Sides or Angles, and Smoothens the Face of the Punch. But yet is not this Face so perfectly Flatned, but that perhaps the middle of it rises more or less, above the Sides: And then he Screws it in his *Hand-Vice*, and leans the Shank of the Punch against the Tach, pretty near upright, and so as he may best command it, and with a *Watch-Makers Half-Round-Sharp-Cut-File*, Files upon it with the Flat-Side of his File; But so that he scarce makes his forward and backward Stroaks longer than the breadth of the Face of his Punch, lest in a long Stroak, the hither or farther end of his File should Mount or Dip, and there-

therefore keeps his File, with the Ball of his Finger upon it, cloſe to the Face of the Punch. Then with the Liner he examines how Flat the Face of the Punch is, and if it be not yet Flat, as perhaps it will not be in ſeveral Trials, he again reiterates the laſt proceſs with the *Small-Half-Round-File*, till it be Flat. But he often Files croſs the Furrows of the File, as well becauſe it makes more riddance, as becauſe he may better diſcern how the File bears on the Face of the Punch.

When it is Flat, he takes a Small well-worn Half-Round-File, and working (as before) with the *Sharp-Cut-File*, he Smoothens the Face of the Punch.

Having thus Flatted the Face of the Punch, and brought the Letter to ſome appearance of Form, He Screws the Punch in the Hand-Vice, but not with the Shank perpendicular to the Chaps, but ſo as the Side he intends to File upon may ſtand upwards and aſlope too, and make an Angle with the Chaps of the Hand-Vice. And holding the Hand-Vice ſteddy in his left hand, he reſts the Shank of the Punch pretty near its Face upon the Tach: and then with a ſmall *Flat-File*, called a *Pillar-File*, in his right hand, holding the Smooth Thin Side of it towards the Footing of the Stem, he Files that Stem pretty near its due Fatneſs, and ſo by ſeveral reiterated proffers, leſt he ſhould File too much of the Stem away, he brings that Stem at laſt to its true Fatneſs. Then he meaſures with the *Aſcending Face-Gage*, the Height of the Letter: For though the *Counter-Punch* was imagin'd
(as

(as aforesaid) to be made to an exact Heighth for the inside of the Letter; yet with deeper or shallower Sinking it into the *Punch*, the inside oft proves higher or lower: Because, as aforesaid, the Superficies of the Face of the *Counter-Punch* is less than the true measure. But as it runs Sholdering into the Shank of the *Counter-Punch* the Figure or Form of the inside becomes bigger than the inside of the Letter ought to be. Therefore the deeper this Sholdering Shank is sunk into the Face of the *Punch*, the higher and broader will the Form of the inside of the Letter be, and the shallower it is Sunk in, the Shorter and Narrower by the Rule of Contraries.

He measures, as I said, with the Affending Face-Gage, and by it finds in what good Size the Letter is. If it be too high, as most commonly it is, because the Footing and Top are yet left Fat, then with several proffers he Files away the Footing and Top, bringing the Heighth nearer and nearer still, considering in his Judgment whether it be properest to File away on the Top or Footing, till at last he fits the Heighth of the Letter by the Affending *Face-Gage*.

But though he have fitted the Heighth of the Letter, yet if the *Counter-Punch* were made a little too little, or Sunk a little too shallow, not only the Footing will prove too Fat, but the Triangle above the Cross-stroke of *A* will be too small; or if too big, the Footing and part of the Top will be Filed away, when it is brought to a due Heighth, and then the Letter is Spoil'd, unless it be so deep Sunk,
that

that by working away the Face, as aforefaid, he can regain the Footing and Top through the Slope-sholdering of the *Counter-Punch*, and alfo keep the infide of the Letter deep enough.

But if the Footing be too *Fat* or the Triangle of the Top too little in the Infide, he uſes the Knife-backt Sculpter, and with one of the edges or both, that proceeds from the Belly towards the Point of the Sculpter (which edges we will for diſtinction ſake call *Angular edges*) he by degrees and with ſeveral proffers Cuts away the Infide of the Footing, or opens the Triangle at the Top or both, till he hath made the Footing lean enough, and the Triangle big enough.

But if he works on the Triangle of the Top, he is careful not to Cut into the Straight of the Infide lines of the Stems, but to keep the Infides of that Triangle in a perfect ſtraight line with the other part of the Infide of the Stem.

The ſmall arch of a Circle on the Top of *A* is Fil'd away with a Sizable Round-File. And ſo for all other Letters that have Hollows on their Outſides; he fits himſelf with a ſmall File of that ſhape and Size that will fit the Hollow that he is to work upon: For thus the Tails of Swaſh Letters in Italick Capitals are Fil'd with half Round Files Sizable to the Hollows of them. But I inſtead of Round or Half-Round Files, in this Caſe, beſpeak Pillar Files of ſeveral Thickneſſes, and cauſe the *File-maker* to Round and Hatch the Edges: which renders the File ſtrong and able to endure hard leaning on, without Breaking, which Round or Half-Round Files will not Bear.

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I need give no more Examples of Letters that are to be Counter-punched: And for Letters that need neither Counter-punching or Graving, they are made as the Out-sides of *A*, with Files proper to the shapes of their Stroaks.

¶. 4. *Of Graving and Sculpting the Insides of Steel Letters.*

The *Letter-Cutter* elects a *Steel Punch* or *Rod*, a small matter bigger than the Size of the Letter he is to Cut; because the Topping or Footing Stroaks will be stronger when they are a little Bevell'd from the Face. The Face of these Letters not being to be Counter-punched are first Flatned and Smoothed, as was shewed, ¶. 3. Then with the proper *Gage*, viz. the Long, the Ascending, or else the Short *Face-Gage*, according as the Letter is that he intends to Cut, He measures off the exact Heighth of the Letter, Thus; He first Files one of the Sides of the Face of the *Punch* (viz. that Side he intends to make the Foot of his Letter) exactly straight; which to do, he screws his *Punch* pretty near the bottom end, with its intended Foot-side uppermost, aslope into one end of the Chaps of his *Hand-Vice*. So that the Shank of the *Punch* lies over the Chaps of the *Hand-Vice*, and makes an Angle of about 45 Degrees with the Superficies of the Chaps of it: Then he lays the under side of the Shank of his *Punch* aslope upon his *Tache*, in one of the Notches of it, that will best fit the size of his *Punch*, to keep it steady; and so Files the Foot-Line of the *Punch*.

But

But he Files not athwart the sides of his *Punch*; for that might make the Foot-Line Roundish, by a Mounting and Dipping the Hand is prone to; as I shewed, *Vol. I. Fol. 15, 16.* But he holds his File so as the Length of it may hang over the Length of the Shank of the *Punch*, and dip upon it at the Face of the *Punch*, with a Bevel, or Angle, of about 100 Degrees with the Face of the *Punch*. This Angle you may measure with the *Beard-Gage*, described in *Plate 10. Fig. C. at k.* Then Filing with the File in this Position, the Foot-Line will be made a true straight Line. But yet he examines it too by applying the *Liner* to it; and holding the *Punch* and *Liner* thus to the Light; If the *Liner* touches all the way on the Foot-Line, he concludes it true; if not, he mends it till it do.

Then he uses his proper *Steel-Gage*, and places the Sholder of it against the Shank of the *Punch* at the Foot-Line; and pressing the Sholder of the *Steel-Gage* close against the Foot-Line, he, with the Tooth of the *Gage* makes a Mark or Race on the side of the Face, opposite to the Foot-line: And that Mark or Race shall be from the Foot-Line, the Bounds of the Heighth of that Letter.

Then on the Face he draws or marks the exact shape of the Letter, with a Pen and Ink if the Letter be large, or with a smooth blunted Point of a Needle if it be small: Then with fizable and proper shaped and Pointed Sculptors and Gravers, digs or Sculps out the Steel between the Stroaks or Marks he made on the Face of the *Punch*, and leaves the Marks standing on the Face.

If

If the Letter be great he is thus to Sculp out, he then, with a Graver, Cuts along the Insides of the drawn or marked Stroaks, round about all the Hollow he is Cutting in. And having Cut about all the sides of that Hollow, he Cuts other straight Lines within that Hollow, close to one another (either parallel or aslope, it matters not) till he have filled the Hollow with straight Lines; and then again, Cuts in the same Hollow, athwart those straight Lines, till he fill the Hollow with Thwart Lines also. Which straight Lines, and the Cuttings athwart them, is only to break the Body of Steel that lies on the Face of the *Punch* where the Hollow must be; that so the Round-Back'd Sculptor may the easier Cut through the Body of the Steel, in the Hollow, on the Face of the *Punch*; even as I told you, *Numb.* 4. *Vol.* I. §. 2. the Fore-Plain makes way for the Fine Plains.

The *Letter-Cutter* does not expect to perform this Digging or Sculpting at one single Operation; but, having brought the Inside of his Letter as near as he can at the first Operation, he, with the flat side of a Well-worn, Small, Fine-Cut, Half-round File, Files off the Bur that his Sculptors or Gravers made on the Face of the Letter, that he may the better and nicelier discern how well he has begun. Then he again falls to work with his Sculptors and Gravers, mending, as well as he can, the faults he finds; and again Files off the Bur as before, and mends so oft, till the Inside of his Letter pleases him pretty well. But before every Mending he Files off the Bur, which else, as afore said, would obscure and hide the true shape of his Stroaks.

Having

Having well fhaped the Infide Stroaks of his Letter, he deepens the Hollows that he made, as well as he can, with his Sculptors and Gravers: And the deeper he makes thefe Hollows, the better the Letter will prove. For if the Letters be not deep enough, in proportion to their Width, they will, when the Letter comes to be Printed on, Print Black, and fo that Letter is fpoiled.

How deep thefe Hollows are to be, cannot be well afferted, becaufe their Widths are fo different, both in the fame Letter, and in feveral Letters: Therefore he deepens them according to his Judgment and Reafon. For Example, O muft be deeper than A need be, becaufe the Hollow of O is wider than the Hollow of A; A having a Crofs Stroak in it; and the wider the Hollow is, the more apt will the wet Paper be to prefs deeper towards the bottom in Printing. Yet this in General for the Depth of Hollows; You may make them, if you can, fo deep as the *Counter-Punch* is directed to be ftruck into the Face of the Punch. See ¶. 3. of this §.

Having with his Gravers and Sculptors deepened them fo much as he thinks convenient, he, with a *Steel Punch*, pretty near fit to the fhape and fize of the Hollow, and Flatted on its Face, Flattens down the Irregularities that the Gravers or Sculptors made, by ftriking with a proper Hammer, upon the Hammer-end of the *Punch*, with pretty light blows. But he takes great care, that this *Flat-Punch* be not at all too big for the Hollow it is to be ftruck into, left it force the fides of the Stroaks of the Letter out of their fhape: And therefore alfo it is, that he ftrikes
but

but easily, though often, upon the end of the *Flat-Punch*.

Having finished the Inside, he works the Outfides with proper Files; as I shewed before, in Letter A; and smoothenes and Pollishes the Outside Stroaks and Face with proper worn-out small *Watch-makers* Files.

The Inside and Outside of the Face thus finished, he considers what Sholdering the Shank of the *Punch* makes now with the Face, round about the Letter. For, as the Shank of the Letter stands farther off the Face of any of the Stroaks, the Sholdering will be the greater when the Letter is first made; because the Outfides of the Letter, being only shaped at first with Fine Small Files, which take but little Steel off, they are Cut Obtusely from the Shank to the Face, and the Steel of the Shank may with Rougher Files afterwards, be Cut down more Tapering to the Shank. For the Sholder of the Shank, as was said before in this ¶, must not make an Angle with the Face, of above 100 Degrees; because else they would be, first, more difficult to Sink into Copper; And Secondly, The broad Sholders would more or less (when the Letter is Cast in such Matrices) and comes to the Press, be subject, and very likely to be-smear the Stroaks of the Letter; especially, with an Hard Pull, and too wet Paper; which squeezes the Face of the Letter deep into the Paper, and so some part of the Broad Sholdering of the Letter, receiving the Ink, and pressing deep into the Paper, flurs the Printed Paper, and so makes the whole Work shew very nasty and un-beautiful.

For

For these Reasons it is, that the Shank of the *Punch*, about the Face, must be Filed away (at least, so much as is to be Sunk into Copper) pretty close to the Face of the Letter; yet not so as to make a Right Angle with the Face of the Letter, but an Obtuse Angle of about 100 Degrees: For, should the Shank be Filed away to a Right Angle, *viz.* a Square with the Face, if any Footing or Topping be on the Letter, these fine Stroaks will be more subject to break when the *Punch* is Sunk into Copper, than when the Angle of the Face and Shank is augmented; because then those fine Stroaks stand upon a stronger Foundation. Therefore he uses the *Beard-Gage*, and with that examines round about the Letter, and makes the Face and Shank comply with that.

Yet Swash-Letters, especially 2, whose Swashes come below the Foot-Line, and whose Length reaches under the Foot-Line of the next Letter, or Letters in Composing, ought to have the Upper Sholder of that Swash Sculpted down straight, *viz.* to a Right Angle, or Square with the Face; at least, so much of it as is to be Sunk into Copper: Because the Upper Sholder of the Swash would else be so broad, that it would ride upon the Face of the next Letter. Therefore the Swash-Letters being all Long Letters, the lower end of the Swashes reach as low as the Bottom-Line; which cannot be Filed Square enough down from the Head-Line, unless the Steel the Swash stands on, should be Filed from end to end, the length of the whole Shank of the *Punch*, which would be very tedious; and besides, would
make

make that part of the Shank the Swash stands on so weak, that it would scarce endure Striking into the Copper. Therefore, as I said before, the Upper Sholder of the Swash ought to be Sculpted down: Yet I never heard of any *Letter-Cutters* that had the knack of doing it; but that they only Filed it as straight down as they could, and left the *Letter-Kerner*, after the Letter was Cast, to Kern away the Sholdering. Yet I use a very quick way of doing it; which is only by Resting the Back of a Graver at first, to make way; and afterwards a Sculptor, upon the Shank of the *Punch*, at the end of the Swash, one while; and another while on the Shank, at the Head, that the Swash may be Sculpted down from end to end: and Sculpting so, Sculp away great Flakes of the Steel at once, till I have Cut it down deep enough, and to a Right Angle.

Then he Hardens and Tempers the Punch; as was shewed, *Numb. 3. Vol. I. Fol. 57, 58.*

But though the *Punch* be Hardned and Temper'd, yet it is not quite finished: for, in the Hardning, the *Punch* has contracted a Scurf upon it; which Scurf must be taken off the Face, and so much of the sides of the Shank as is to be Sunk into Copper. Some *Letter-Cutters* take this Scurf off with small smooth Files, and afterwards with fine Powder of *Emerick*. The *Emerick* they use thus. They provide a Stick of Wood about two Handful long, and about a *Great-Primer*, or *Double-Pica* thick: Then in an Oyfter-shell, or any sleight Concave thing, they powr a little Sallad-Oyl, and put Powder of *Emerick* to it, till it become of the Consistence of Batter
made

made for Pan-cakes. And stirring this Oyl and *Emerick* together, spread or smear the aforefaid Stick with the Oyl and *Emerick*, and so rub hard upon the Face of the *Punch*, and also upon part of the Shank, till they have taken the Scurf clean off.

Mr. *Walberger* of *Oxford* uses another way. He makes such an Instrument as is described in *Plate* 10. at H, which we will, for distinction sake, call the *Joynt-Flat-Gage*. This Instrument consists of two Cheeks about nine Inches long, as at b, and are fastened together at one end, as the Legs of a *Carpenter's* Joynt-Rule are in the Centre, as at c, but with a very strong Joynt; upon which Centre, or Joynt, the Legs move wider, or closer together, as occasion requires. Each Leg is about an Inch and a quarter broad, and an Inch and three quarters deep; viz. so deep as the Shank of the *Punch* is long. At the farther end of the Shank b (as at d) is let in an Iron Pin, with an Head at the farther end, and a square Shank, to reach almost through a square Hole in the Shank b, that it twists not about; and at the end of that Square, a round Pin, with a Male-Screw made on it, long enough to reach through the Shank a, and about two Inches longer, as at e; upon which Male-Screw is fitted a Nut with two Ears, which hath a Female-Screw in it, that draws and holds the Legs together, as occasion requires a bigger or less *Punch* to be held in a proper Hole. Through each of the adjoining Insides of the Legs are made, from the Upper to the Lower Side, six, seven, or eight Semi-Circular Holes (or more or less, according to discretion) exactly Perpendicular to

to the upper and under Sides of each Leg, marked *a a a a*, *b b b b*. Each of these Semicircular Holes is, when joyned to its Match, on the other Leg to make a Circular Hole; and therefore must be made on each Leg, at an equal distance from the Centre. These Holes are not all of an equal Size, but different Sizes: Those towards the Centre smallest, *viz.* so small, that the *Punch* for the smallest Bodied Letters may be pinched fast in them; and the biggest Holes big enough to contain, pinch and hold fast the *Punches* for the great Bodied Letters. The upper and under sides of this *Joynt-Flat-Gage* is Faced with an Iron Plate, about the thickness of an Half Crown, whose outer Superficies are both made exactly Flat and Smooth.

When he uses it, he chuses an Hole to fit the Size of the *Punch*; and putting the Shank of the *Punch* into that Hole, Sinks it down so low, till the Face of the *Punch*, stands just Level, or rather, above the Face of the *Joynt-Flat-Gage*: Then with a piece of an Hone, wet in Water, rubs upon the Face of the *Punch*, till he have wrought off the Scurf. At last, with a Stick and Dry *Putty*, Polishes it.

I like my own way better than either of the former: For, to take off the Scurf with Small Files spoils the Files; the Face of the *Punch* being Hard, and the Scurf yet Harder: And besides, endangers the wronging the Face of the *Punch*.

The *Joynt-Flat-Gage* is very troublesome to use, because it is difficult to fit the Face of the *Punch*, to lie in the Plain of the Face of the *Gage*; especially, if, in making the Letter, the Shank be Filed Tapering,

ing, as it most times is. For then the Hammer-end of the *Punch* being bigger than the Face-end, it will indeed Pinch at the Hammer-end, whilst the Face-end stands unsteady to Work on. But when the *Punch* is fitted in, it is no way more advantagious for Use, than the Chaps of the *Hand-Vice* I mentioned in ¶. 3. of this §.

Wherefore, I fit the *Punch* into the Chaps of the *Hand-Vice*, as I shewed in the aforesaid ¶. and with a fine smooth Whet-stone and Water, take the Scurf lightly off the Face of the *Punch*; and afterwards, with a fine smooth Hone and Water, work down to the bare bright Steel. At last, drying the *Punch* and Chaps of the *Hand-Vice* with a dry Rag, I polish the Face of the *Punch* with Powder of Dry *Brick* and a Stick, as with *Putty*.

¶. 5. *Some Rules he considers in using the Gravers, Sculptors, Small Files, &c.*

1. When he is Graving on the Inside of the Stroak, either to make it Finer or Smoother, he takes an especial care that he place his Graver or Sculptor so, as that neither of its Edges may wrong another Stroak of the Letter, if they chance (as they often do) to flip over, or off an extuberant part of the Stroak he is Graving upon. And therefore, I say, he well considers how he is to manage the edges of his Graver. For there is no great danger of the point of his Graver after the inside Stroaks are form'd, and the Hollows of the Letter somewhat deepned; but in the edges there is: For the point
in

in working lies always below the Face of the Letter, and therefore can, at most, but slip below the Face, against the side of the next Strok; but the edges lying above the Face of the Letter, may, in a slip, touch upon the Side and Face of the next Strok, and wrong that more or less, according as the force of the Slip was greater or smaller. And if that Strok it jobs against were before wholly finished, by that job the whole Letter is in danger to be spoiled; at the best, it cannot, without Filing the Letter lower, be wrought out; which sometimes is a great part of doing the Letter anew: For he takes special care that neither any dawb, or the least extuberant bunching out be upon the inside of the Face of the Strok, but that the inside of the Strok (whether it be Fat or Lean) have its proper Shape and Proportion, and be purely smooth and clean all the way.

If on the inside of the Strok the Graver or Sculptor have not run straight and smooth on the Strok, but that an Extuberance lies on the Side, that Extuberance cannot easily be taken off, by beginning to Cut with the Edge of the Graver or Sculptor just where the Extuberance begins: Therefore he fixes the Point of his Graver or Sculptor in the Bottom of the Hollow, just under the Strok where the Extuberance is, and leans the Edge of his Graver or Sculptor upwards; so as in forcing the Point of the Graver or Sculptor forwards, at the Bottom of the Hollow, the Edge of the Graver or Sculptor may slide tenderly along, and take along with it a very small, nay, invisible Chip of the most Prominent Part of the Extuberance; and so, by this Process reiterated

ted often, he, by small Degrees, Cuts away the Extuberant part of the Stroak.

2. He is careful to keep his Gravers and Sculptors always Sharp, by often Sharpning them on the Oyl-Stone, which for that purpose he keeps ready at hand, standing on the Bench: For if a Graver or Sculptor be not sharp, it will neither make riddance, or Cut smooth; but instead of Cutting off a small Extuberancy, it will rather stick at it, and dig into the Side of the Stroak.

3. He Files very tenderly with the Small Files, especially with the Knife-Files, as well because they are Thin and Hard, not Temper'd, and therefore would snap to pieces with small violence; as also, lest with an heavy hand he should take away too much at once of that Stroak he is working upon.

§. 14. ¶. 1. *Some Rules to be observed by the Letter-Cutter, in the Cutting Roman, Italick, and the Black English Letter.*

1. The Stem and other Fat Stroaks of Capital *Romans* is five Parts of forty and two (the whole Body:) Or, (which is all one) one sixth part of the Heighth of an Ascending Letter (as all Capitals are Ascendents) as has been said before. *Albertus Durer* took his Measure from the Heighth of Capitals, and assigned but one tenth part for the Stem.

2. The Stem, and other Fat Stroaks of Capitals *Italick*, is four parts of forty and two, (the Body.)

3. The Stem, and other Fat Stroaks of Lower-Case *Roman*, is three and an half parts of forty and two, (the Body.)

4. The

4. The Stem, and other Fat Stroaks of Lower-Cafe *Italick*, is three parts of forty and two, (the Body.)

5. Of *English*, the Short Letters stand between nine parts of the Bottom-Line, and nine parts from the Top-Line; *viz.* upon three and thirty parts of forty and two, (the Body.)

6. The Stem of *English* Capitals is six parts of forty and two, (the Body.)

7. The Stem of *English* Lower-Cafe Letters is four parts of forty and two, (the Body.)

¶. 2. *Of Terms relating to the Face of Letters, and their Explanation.*

The Parts of a *Punch* are already described in §. 13. ¶. 1. of this Volumne; and so is the Body: But the several Terms that relate to the Face of Letters are not yet defined. Now therefore you must note, that the Body of a Letter hath four principal Lines passing through it (or at least imagined to pass through it) at Right Angles to the Body; *viz.* The Top-Line, The Head-Line, The Foot-Line, and The Bottom-Line.

Between two of these Lines is contained the Heighth of all Letters.

These are called *Lines*, because the Tops, the Heads, the Feet and the Bottoms of all Letters (when Complicated by the *Compositor*) stand ranging in these imagin'd Lines, according as the Heighth and Depth of each respective Letter properly requires.

The

The Long Letters are (as I told you in §. 13. ¶. 1. of this Volumne) contained between the Top and Bottom-Lines, The Ascending Letters are contained between the Top and Foot-Lines, The Descending Letters are contained between the Head and Bottom-Lines, and The Short Letters are contained between the Head and Foot-Lines.

Through what Parts of the Body all thefe Lines paſs, you may fee by the Drafts of Letters, and the following Deſcriptions.

What the Long Letters, Ascending Letters, and Short Letters are, I ſhewed in the afore-cited ¶. Therefore I ſhall now proceed to particular Terms relating to the Face. As,

1. The Topping, is the ſtraight fine Stroak or Stroaks that lie in the Top-Line of Ascending Letters: In *Roman* Letters they paſs at Right Angles through the Stems; but in *Italicks*, at Oblique Angles to the Stems; as you may fee in the Drafts of Letters, B, *B*, H, *H*, I, *I*, &c.

2. The Footing, is the ſtraight fine Stroak or Stroaks that lie in the Foot-Line of Letters, either Ascending or Descending. In *Romans* they paſs at Right Angles through the Stem, but in *Italicks*, at Oblique Angles; as you may fee in B, *B*, H, *H*, I, *I*, &c.

3. The Bottom-Footing, is the ſtraight fine Stroaks that lie in the Bottom-Line of Descending Letters. In *Romans* they paſs at Right Angles through the Stem; but in *Italicks* at Oblique Angles; as you may fee p, *p*, q, *q*.

4. The

4. The Stem is the straight Fat Stroak of the Letter: as in B, *B*, the straight Stroak on the Left Hand is the Stem; and I, *I*, is all Stem, except the Footing and Topping.

5. Fat-Stroaks. The Stem or broad Stroak in a Letter is called Fat; as the Right Hand Stroak in A, and part of the great Arch in B, are Fat Stroaks.

6. Lean Stroaks, are the narrow fine Stroaks in a Letter; as the Left Hand Stroak of A, and the Right Hand Stroak of V are Lean.

7. Beak of Letters, is the fine Stroak or Touch that stands on the Left Hand of the Stem, either in the Top-Line, as b d h, &c. or in the Head-Line, as i, m, n, &c. Yet f, g, *f*, *g*, *f*, have Beaks on the Right Hand of the Stem.

8. Tails of Letters, is a Stroak proceeding from the Right Hand Side of the Stem, in the Foot-Line; as a d t u: and most *Italick* Lower-Case Letters have Tails: As also have most Swash Letters. But several of their Tails reach down to the Bottom-Line.

9. Swash Letters are *Italick* Capitals; as you see in *Plate 15*.

Thus much of *Letter-Cutting*. The next *Exercises* shall (God willing) be upon *Making Matrices, Making Molds, Casting and Dressing of Letters, &c.*

F I N I S.

ADVERTISEMENT.

NUmb. 4. of the *Second Volumne of Collections of Letters for Improvement of Husbandry and Trade, is now extant; being Enquiries relating to Husbandry and Trade: drawn up by the Learned Robert Plot, L. L. D. Keeper of the Ashmolean Musæum, and Professor of Chymistry in the University of Oxford, and Secretary of the Royal Society of London. An Account of the manner of making Brunswick-Mum. An Account of a great Improvement of Mossy Land, by Burning and Liming; from Mr. Adam Martindale of Cheshire.*

To be had at the *Angel in Cornhil*, and several other Booksellers.

A B C D E

A Scale of 42 Parts viz. the Body:

F G H I J

K L M N

O P Q R

S T V U

W X Y Z

Æ a b c d e f

A Scale of 42 Parts viz. the Body.

6 12 18 24 30 36 42

g h i j k l m n

o p q r s t v

u w x y z &

ct st fh ffi æ œ

I 2 3 4 5 6 7 8 0

Plate 13.

A B C D E

A Scale of 42 Parts viz. the Body.

6 12 18 24 30 36 42

F G H I K

L M N O

P Q R S T

V W X Y

Z Æ

Plate 14.

a b c d e f g h i

A Scale of 42 Parts Viz. the Body.

6 12 18 24 30 36 42

j k l m n o p q

r s t u v w x

y z & c t s t s b

æ œ s s i f f f f f

Plate 15.

A B C D E

A Scale of 42 Parts viz. $\frac{5}{8}$ Body

6 12 18 24 30 36 42

F G H f K

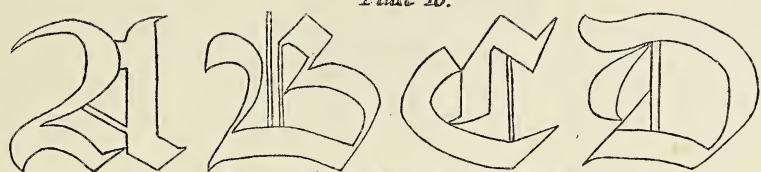
M N P

Q R T

U X Y Z

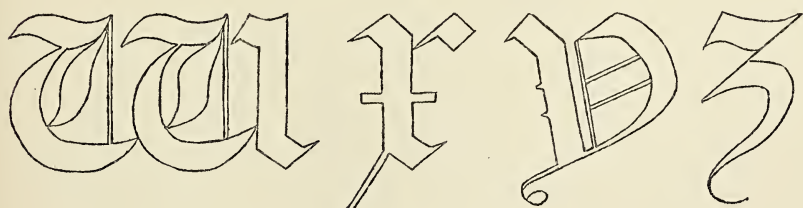
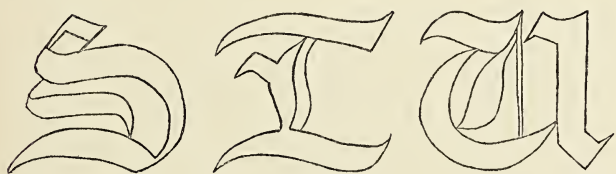
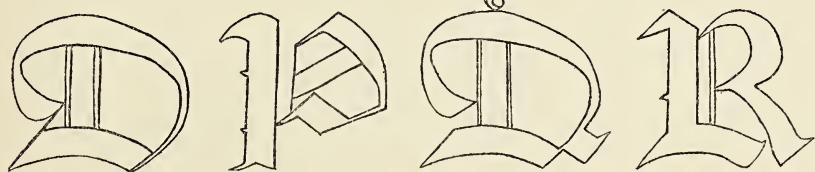
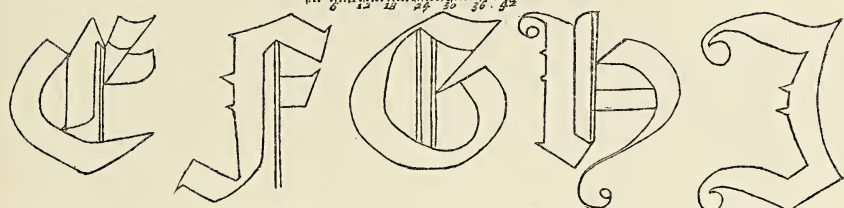
Æ

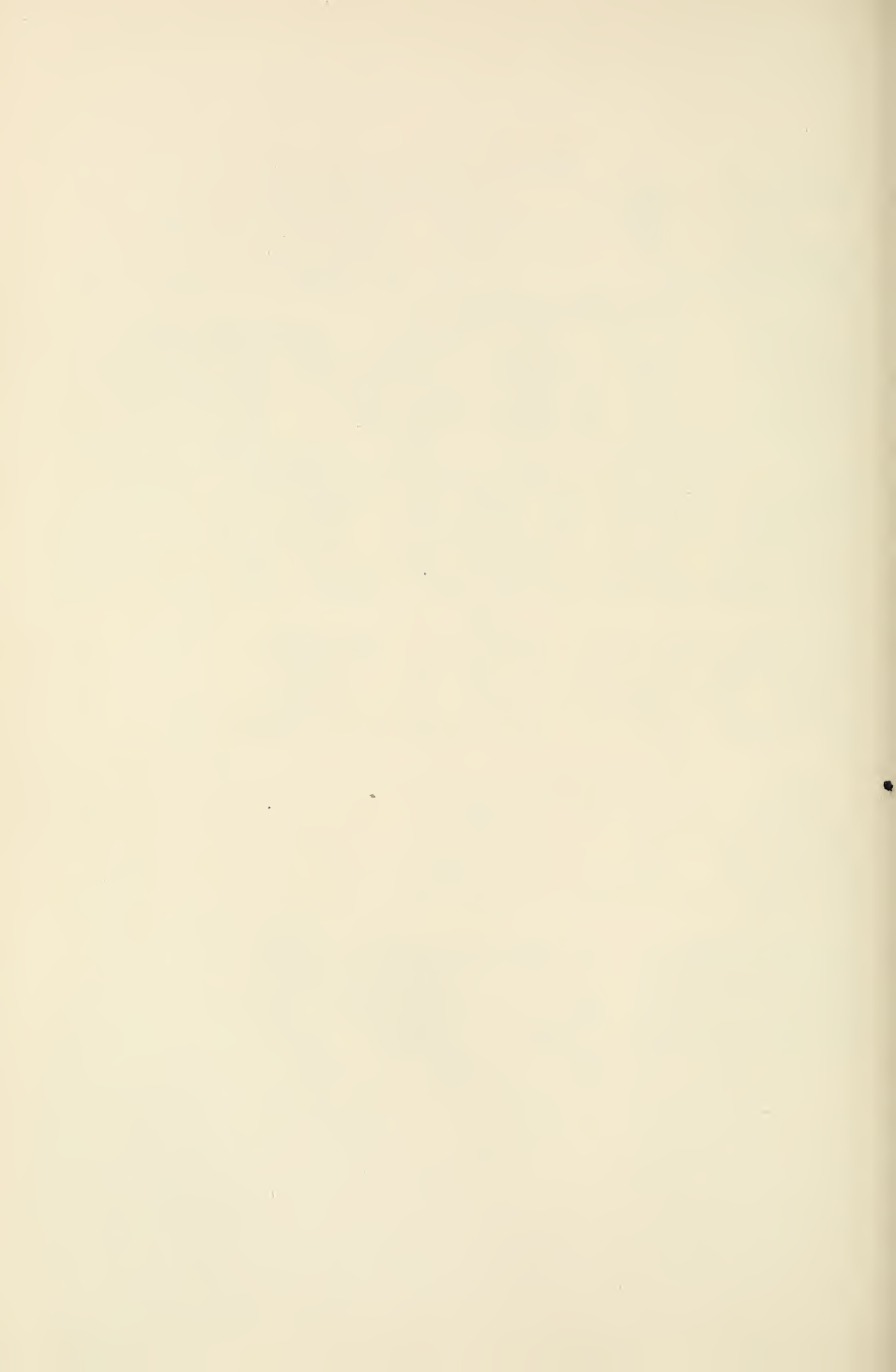
Plate 16.



A Scale of 42 Parts viz the Body

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42





a b c d e f g h i j

A Scale of 42 Parts viz the Body:

k l m n o p q r

s t u v w x y

z t o t t t t t t t

flæœ P S * †

;;..? '(!

MECHANICK EXERCISES:

Or, the Doctrine of

Handy-works.

Applied to the ART of

*Mold-Making, Sinking the Matrices,
Casting and Dressing of***Printing-Letters.**

§. 15. ¶. 1. *Of making the Mold.*

THE *Steel Punches* being thus finish'd, as afore was shewed, they are to be sunk or struck into pieces of *Copper*, about an Inch and an half long, and one quarter of an Inch deep; but the thickness not assignable, because of the different thicknesses in Letters, as was shewed in §. 2. and shall further be shewed, when I come to the sinking and justifying

stifying of *Matrices*. But before these *Punches* are sunk into *Copper*, the *Letter-Founder* must provide a *Mold* to justify the *Matrices* by: And therefore it is proper that I describe this *Mold* to you before I proceed any farther.

I have given you in Plate 18. at A, the Draft of one side or half of the *Mold*; and in Plate 19. at B, its Match, or other half, which I shall in general thus describe.

Every *Mold* is made of two parts, an under, and an upper Part; the under part is delineated at A, in Plate 18, the upper part is marked B, in Plate 19, and is in all respects made like the under part, excepting the *Stool* behind, and the *Bow*, or *Spring* also behind; and excepting a small roundish *Wyer* between the *Body* and *Carriage*, near the *Break*, where the under part hath a small rounding *Groove* made in the *Body*. This *Wyer*, or rather *Half-Wyer* in the upper part makes the *Nick* in the *Shank* of the *Letter*, when part of it is received into the *Grove* in the under part.

These two parts are so exactly fitted and gaged into one another, (*viz.* the *Male Gage*, marked C in Plate 19, into the *Female-Gage* marked g, in Plate 18.) that when the upper part of the *Mold* is properly placed on, and in the under part of the *Mold* both together, makes the entire *Mold*, and may be slid backwards for Use so far, till the Edge of either of the *Bodies* on the middle of either *Carriage* comes just to the Edge of the *Female-Gages*, cut in each *Carriage*: And they may be slid forwards so far, till the *Bodies* on either *Carriage* touch each other. And the sliding of these two parts of the *Mold* backwards,
makes

makes the *Shank* of the Letter thicker, because the Bodies in each part stand wider asunder; and the sliding them forwards makes the *Shank* of the Letter thinner, because the Bodies on each part of the *Mold* stand closer together.

This is a general Description of the *Mold*; I come now to a more particular Description of its parts.

a The *Carriage*.

b The *Body*.

c The *Male-Gage*.

d e The *Mouth-Piece*.

f i The *Register*.

g The *Female-Gage*.

h The *Hag*.

a a a a The *Bottom Plate*.

b b b The *Wood* the *Bottom Plate* lies on.

c c e The *Mouth*.

d d The *Throat*.

e d d The *Pallat*.

f The *Nick*.

g g The *Stool*.

h h g The *Spring* or *Bow*.

I have here given you only the Names of the parts of the *Mold*, because at present I purpose no other Use of it, than what relates to the sinking the *Punches* into the *Matrices*: And when I come to the casting of Letters, You will find the Use and Necessity of all these Parts.

¶ 2. Of the Bottom-Plate.

The *Bottom Plate* is made of *Iron*, about two Inches and three quarters long, and about the same breadth; its thickness about a *Brevier*: It is planisht exactly flat and streight: It hath two of its *Fore-Angles*, as a *a* cut off either straight or rounding, according to the pleasure of the Work-man.

About the place where the middle of the *Carriage* lies, is made a Hole about a *Great Primmer* square, into which is rivetted on the upper side a Pin with a Sholder to it, which reaches about half an Inch through the under side of the *Bottom Plate*. This *Pin* on the under side the *Bottom Plate* is round, and hath a *Male-Screw* on its end. This *Pin* is let through a Hole made in the Wood of the *Mold* to fit it; so that when a square *Nut*, with a *Female-Screw* in it, is turned on the *Male-Screw*, it may draw and fasten the *Half Mold* firm to the Wood.

The Hind side of the *Carriage* lies on this *Bottom-Plate*, parallel to the Hind side of it, and about a *Two-Lin'd-English* within the Hind Edge of it; and so much of this *Bottom-Plate* as is between the *Register* and the left hand end of the *Carriage* (as it is posited in the Figure) is called the *Stool*, as *g g* in the under half of the *Mold*, because on it the lower end of the *Matrice* rests; but on the upper half of the *Mold* is made a square Notch behind in the *Bottom-Plate*, rather within than without the Edge of the *Carriage*, to reach from the *Register*, and half an Inch towards the left hand (as it is posited in the Figure)

that

that the upper part of the fore-side of the *Matrice* may stand close to the *Carriage* and *Body*.

¶ 3. *Of the Carriage.*

On the *Bottom-Plate* is fitted a *Carriage*, (as *a*) This *Carriage* is almost the length of the *Bottom-Plate*, and about a *Double Pica* thick, and its Breadth the length of the Shank of the Letter to be cast.

This *Carriage* is made of *Iron*, and hath its upper side, and its two narrow sides filed and rubbed upon the using *File*, exactly straight, square and smooth, and the two opposite narrow sides exactly parallel to each other.

On one end of the *Carriage*, as at *g*, is made a long *Notch* or *Slit*, which I call the *Female-Gage*: It is about a *Double Pica* wide, and is made for the *Male-Gage* of the other part of the *Mold* to fit into, and to slide forwards or backwards as the thickness of the Letter to be cast may require.

¶ 4. *Of the Body.*

Upon the *Carriage* is fitted the *Body*, as at *b*. This *Body* is also made of *Iron*, and is half the length of the *Carriage*, and the exact breadth of the *Carriage*; but its thickness is alterable, and particularly made for every intended *Body*.

About the middle of this *Body* is made a square Hole, about a *Great Primmer*, or *Double Pica* square; and directly under it is made through the *Carriage* such another Hole exactly of the same size.

¶ 5. *Of*

¶ 5. *Of the Male-Gage.*

Through thefe two Holes, *viz.* That in the *Body*, and that in the *Carriage*, is fitted a square *Iron Shank* with a *Male-Screw* on one End, and on the other End an Head turning square from the square *Shanck* to the farther end of the *Body*, as is defcribed at c; but is more particularly defcribed apart at B in the fame Plate, where B may be called the *Male-Gage*: For I know no diftinct Name that *Founders* have for it, and do therefore coyn this:

a The *square Shanck*.

b The *Male-Screw*.

This *square Shanck* is juft fo long within half a *Sca-board* thick as to reach through the *Body*, *Carriage*, and another square Hole made through the *Bottom-Plate*, that fo when a *square Nut* with a *Female-Screw* in it is turned on that *Pin*, the *Nut* fhall draw and faften the *Body* and *Carriage* down to the *Bottom-Plate*.

The Office of the *Male-Gage* is to fit into, and slide along the *Female-Gage*.

¶ 6. *Of the Mouth-Piece.*

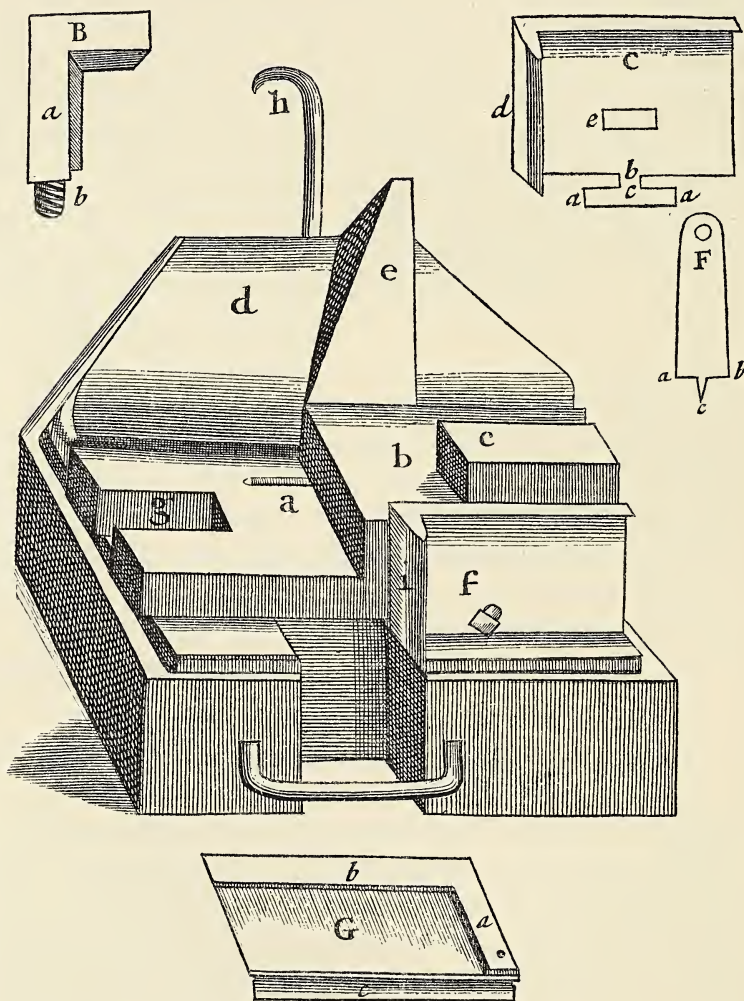
Clofe to the *Carriage* and *Body* is fitted a *Mouth-Piece* marked d e. *Letter-Founders* call this altogether a *Mouth-Piece*: But that I may be the better underftood in this prefent purpofe, I muft more nicely diftinguifh its parts, and take the Freedom to elect Terms for them, as firft,

c c e The *Mouth*.

d The

Plate 19.

The Upper half of the Mold



d The *Palate*.

c c e d The *Jaws*.

d d The *Throat*.

Altogether (as aforesaid) the *Mouth-Piece*.

The *Mouth-Piece* hath its *Side* returning from the *Throat* filed and rubb'd on the *Using File* exactly straight and square to its *Bottom-side*, because it is to joyn close to the *Side* of the *Carriage* and *Body*; but its upper *Side*, viz. the *Palate* is not parallel to the *Bottom*, but from the *Side d d*, viz. the *Throat* falls away to the *Mouth e*, making an *Angle* greater or smaller, as the *Body* that the *Mold* is made for is bigger or less: For small *Bodies* require but a small *Mouth*, because small *Ladles* will hold Metal enough for small Letters; and the smaller the *Ladle*, the finer the *Geat* of the *Ladle* is; and fine *Geats* will easier hit the *Mouth* (in a Train of Work) than the coarse *Geats* of Great *Ladles*: Therefore it is that the *Mouth* must be made to such a convenient Width, that the *Ladle* to be used and its *Geat*, may readily, and without flabbering, receive the Metal thrown into the *Mold*.

But again, if the *Mouth-Piece* be made too wide, viz. the *Jaws* too deep at the *Mouth*, though the *Geat* of the *Ladle* does the readier find it, yet the *Body* of the *Break* of the *Letter* will be so great, that first it heats the *Mold* a great deal faster and hotter; and secondly, it empties the *Pan* a great deal sooner of its Metal, and subjects the Workman sometime to stand still while other Metal is melted and hot: Therefore Judgment is to be used in the width of the *Mouth*; and though there be no Rule for the width of it; yet this in general for such *Molds* as I
make

make, I observe that the *Orifice* of the *Throat* may be about one quarter of the *Body* for small Bodies; but for great Bodies less, according to Discretion, and the *Palate* about an Inch and a quarter long from the *Body* and *Carriage*. The reason that the *Orifice* of the *Throat* is so small, is, because the Substance at the end of the *Shanck* of the Letter ought also to be small, that the *Break* may easier break from the *Shanck* of the Letter, and the less subject the *Shanck* to bowing; for the bowing of a Letter spoils it; and the reason why the *Palate* is so long, is, that the *Break* being long, may be the easier finger'd and manag'd in the breaking.

If it be objected, that since the smallness of the *Break* at the end of the *Shanck* of the Letter is so approvable and necessary for the reason aforesaid, then why may not the *Break* be made much more smaller yet? The Answer will be, No; because if it be much smaller than one quarter of the *Body*, Metal enough will not pass through the *Throat*, to fill both the *Face* and *Shanck* of the Letter, especially if the Letter to be cast prove thin.

Near the *Throat* and *Jaw* is made straight down through the *Palate* a square Hole (as at *k*.) This square Hole hath all its Sides on the *Upper-Plain* of the *Palate* opened to a *Bevel* of about 45 Degrees, and about the depth of a thick *Scaboard*. Into this square *Hole* is fitted a square *Pin* to reach through it; and within half a *Scaboard* through a square *Hole*, made just under it in the *Bottom-Plate* which the *Mouth-Piece* lies upon. On the upper end of this square *Pin* is made a square *Sholder*, whose under sides are filed *Bevil* away, so as
the

to comply and fall juſt into the *Bevil* made on the *Palate* aforeſaid, and on the under end of the *Pin* is made a *Male-screw* long enough to contain a ſquare *Nut*, with a *Female-screw* in it about a *Pica* or *Engliſh* thick, which *Nut* being twiſted about the *Pin* of the *Male-screw*, draws and faſtens the *Mouth-piece* cloſe down to the *Bottom-Plate*, and alſo cloſe to the *Carriage* and *Body* of the *Mold*.

Note, that the ſquare *Hole* made in the *Bottom-Plate* to receive the ſquare *Shanck* of the *Pin*, muſt be made a little wider than juſt to fit the ſquare *Shanck* of the *Pin*, becauſe the *Mouth-piece* muſt be ſo placed, that the end of the *Jaw* next the *Throat* muſt lie juſt even with the *Body* it is to be joyned to; and alſo that the *Throat* of the *Mouth-piece* may be thruſt perfectly cloſe to the Sides of the *Carriage* and *Body*: And when Occaſion requires the *Shanck* of the Letter to be lengthened, it may be ſet farther off the *Carriage*, that an *Aſidue*, or ſometimes a thin *Plate* of *Brass* may be fitted in between the *Carriage* and the *Throat* of the *Mouth-piece*, as ſhall farther be ſhewed when I come to juſtify the *Mold*.

¶ 7. Of the Register.

Behind the *Mold* is placed the *Register*, as at *f i h*, which I have alſo placed apart in the aforeſaid Plate, as at *C*, that it may the more perſpicuouſly be diſcerned, and a more particular account of its parts be given, which are as follows:

C a a b c d e The *Register*.

a a The *Sholders*.

b c The

b c The Neck.

d The Cheek returning fquare from the Plate of the Register, and is about an *Engliſh* thick.

e The Screw Hole.

It is made of an *Iron* Plate about a *Brevier* thick; its upper Side is ftraight, but its under Side is not: For at *a a* projects downwards a fmall piece of the fame Plate, which we may call the *Sholders*, of the Form you fee in the Figure. Theſe *Sholders* have two fmall *Notches* (as at *b c*) filed in them below the *Range* on the under fide of the Register, which we will call the Neck, and is juſt ſo wide as the *Bottom-Plate* is thick. This Neck is fet into a fquare *Notch*, filed ſo far into the *Bottom-Plate*, that the flat infide of the Register may ſtand cloſe againſt the hind fide of the Carriage and *Body*; and this *Notch* is filed ſo wide on the left Hand, that when the fide *b* of the Neck ſtands cloſe againſt the left-hand Side of this *Notch* (as it is poſited in the Figure) the Cheek of the Register ſtands juſt even with the Edge of the *Body*. And this *Notch* is alſo filed ſo wide on the right-Hand Side, that when the Neck at *c* ſtands cloſe againſt the right-hand Side of the *Notch*, the Cheek of the Register may remove an m, or an m and an n from the edge of the *Body* towards the right hand: And the *Sholders a a* are made ſo long, that when either Side of the Neck is thruſt cloſe againſt its correſponding fide in the *Notch* of the *Bottom-Plate*, the upper Edge of the oppoſite *Sholder* ſhall hook or bear againſt the under fide of the *Bottom-Plate*, and keep the whole Register ſteady, and directly upright to the Surface of the *Bottom-Plate*.

In

In the Plate of the *Register*, is made a long square Hole, as at *e*, just wide enough to receive the *Pin* of a *Male-screw*, with a *Sholder* to it, which is to fit into a *Female-screw*, made in the Edge of the *Carriage*, that when the *Male-screw* is turned about in the *Female-screw* in the *Carriage*, it shall draw the *Sholder* of the said *Male-screw* hard against the upper and under Sides of the square Hole in the Plate of the *Register*, close to the side of the *Carriage* and *Body*.

The reason why the Hole in the Plate of the *Register* is made so long, is that the *Cheek* of the *Register* may be slid forwards or backwards as occasion requires; as shall be shewn when I come to justifying the *Mold*.

¶ 8. Of the Nick.

In the upper half of the *Mold*, at about a *Pica* distance from the *Throat*, is fitted into the under side of the *Body* the *Nick*: It is made of a piece of *Wyer* filed flat a little more than half away. This *Nick* is bigger or less, as the *Body* the *Mold* is made for is bigger or less; but its length is about two *m*'s. It is with round *Sculptors* let exactly into the under side of the *Body*.

In the under half of the *Mold*, is made at the same distance from the *Throat*, on the upper side of the *Body*, a round *Groove*, just fit to receive the *Nick* in the upper half.

¶ 9 Of

¶ 9. Of the Bow or Spring.

This is a long piece of hard *Iron Wyer*, whose Diameter is about a *Brevier* thick, and hath one end fastned into the Wood of the under half of the *Mold*, as at *h*; but it is so fastned, that it may turn about in the Hole of the Wood it is put into: For the end of it being batter'd flat, a small Hole is drilled through it, into which small Hole the end of fine *Lute-string Wyer*, or somewhat bigger is put, and fastned by twisting about half an Inch of the end of the *Lute-string* to the rest of the *Lute-string*: For then a considerable Bundle of that *Wyer*, of about the Size of a Doublet Button, being wound behind the Hole, about the end of the *Spring*, will become a *Sholder* to it, and keep the end of the *Spring* from slipping through the Hole in the Wood: But this *Button* or *Sholder* must also be kept on by thrusting another piece of *Wyer* stiff into the Hole made on the end of the *Spring*, and crooking that *Wyer* into the Form of an S, that it slip not out of the Hole.

The manner how the *Spring* is bowed, you may see in the Figure: But just without the Wood is twisted upon another *Wyer* about an *English* thick five or six turns of the *Wyer* of the *Spring*, to make the whole *Spring* bear the stronger at its point: For the Office of the *Spring* is with its Point at *g*, to thrust the *Matrice* close against the *Carriage* and *Body*.

¶ 10. Of

¶ 10. *Of the Hooks, or Haggs.*

These are *Iron Wyers* about a *Long Primmer* thick: Their Shape you may see in the Figure: They are so fastned into the Wood of the *Mold*, that they may not hinder the *Ladle* hitting the *Mouth*. Their Office is to pick and draw with their Points the *Break* and *Letter* out of the *Mold* when they may chance to stick.

¶ 11. *Of the Woods of the Mold.*

All the *Iron Work* aforesaid of the *Mold* is fitted and fastned on two Woods, *viz.* each half one, and each Wood about an Inch thick, and of the shape of each respective *Bottom-Plate*. The Wood hath all its Sides except the hind-side, about a *Pica* longer than the *Bottom-Plate*; but the hind-side lies even with the *Bottom-Plate*. The *Bottom-Plate*, as afore was said in ¶ 2. of this §. hath an *Iron Pin* on its under side, about half an Inch long, with a *Male-screw* on its end, which *Pin* being let fit into an Hole in the Wood does by a *Nut* with a *Female-screw* in it draw, all the *Iron Work* close and fast to the Wood.

But because the Wood is an Inch thick, and the *Pin* in the *Bottom-Plate* but half an Inch long, therefore the outer or under side of the Wood (as posited in the Figure) hath a wide round Hole made in it flat at the Bottom, to reach within an *English*, or a *Great Primmer* of the upper side of the Wood. This round Hole is wide enough to receive the *Nut* with the *Female-*

male-screw in it; and the *Pin* being now long enough to receive the *Female-screw* at the wide Hole, the *Female-screw* may with *round nosed Plyers* be turned about the *Male-screw* on the *Pin* aforefaid, till it draw all the *Iron Work* clofe to the *Wood*.

The *Wood* behind on the upper half is cut away as the *Bottom-Plate* of that half is; and into the thicknefs of the *Wood*, clofe by the right and left-hand fide of this *Notch* is a fmall fquare *Wyer-staple* driven, which we may call the *Matrice-Check*; for its Office is only to keep the *Shanck* of the *Matrice* from flying out of this *Notch* of the *Mold* when the *Cafter* is at Work. And the *Nuts* and *Screws* of the *Carriage* and *Mouth-piece*, &c. that lie under the *Bottom-Plate*, are with fmall *Chiffels* let into the upper fide of the *Wood*, that the *Bottom-plates* may lie flat on it.

Sect. XVI. *Of juftifying the Mold.*

ALthough the *Mold* be now made; nay, very well and Workman-like made, yet is it not imagin'd to be fit to go to work withal; as well becaufe it will doubtlefs Rag (as *Founders* call it; for which Explanation fee the Table) as becaufe the Body, Thicknefs, Straightnefs, and length of the *Shanck* muft be finifht with fuch great Nicety, that without feveral Proofs and Tryings, it cannot be expected to be perfectly true.

Therefore before the finking and juftifying the *Matrices*, the *Mold* muft firft be *Juftified*: And firft, he juftifies the *Body*, which to do, he cafts about twenty *Proofs* or Letters, as they are called, though it
matters

matters not whether the *Shancks* have yet Letters on them or no. These *Proofs* he sets up in a *Composing-stick*, as is described in § 17. ¶ 2. Plate 19. at G, with all their *Nicks* towards the right Hand, and then sets up so many Letters of the same *Body*, (which for Distinction-sake we will call *Patterns*) that he will justify his *Body* too, upon the *Proofs*, with all their *Nicks* also to the right Hand, to try if they agree in length with the same Number of Letters that he uses for his *Pattern*; which if they do not, for very seldom they do, but by the Workman's fore-cast are generally somewhat too big in the *Body*, that there may be Substance left to *Justify* the *Mold*, and clear it from *Ragging*. Therefore the *Proofs* may drive out somewhat, either half a Line (which in *Founders* and *Printers* Language is half a *Body*) or a whole Line. (more or less.)

He also tries if the two sides of the *Body* are parallel, *viz.* That the *Body* be no bigger at the *Head* than at the *Foot*; and that he tries by taking half the number of his *Proofs*, and turning the Heads of them lays them upon the other half of his *Proofs*, so that if then the *Heads* and *Feet* be exactly even upon each other, and that the Heads and Feet neither *drive out*, nor *get in*, (*Founders* and *Printers* Language, for which see the Table) the two sides of the *Body* are parallel; but if either the *Head* or *Foot* *drives out*, the two sides of the *Body* are not parallel, and must therefore be mended.

And as he has examin'd the Sides of the *Body* so also he examines the thickness of the Letter, and tries if the two Sides of the thickness be also parallel, which
to

to do, he sets up his *Prooves* in the *Composing-stick* with their *Nicks* upwards. Then taking half of the *Prooves*, he turns the *Heads* and lay the *Heads* upon the *Feet* of the other half of his *Prooves*, and if the *Heads* and *Feet* lies exactly upon each other and neither *drive-out* or *get-in* the two Sides of the thicknesses are parallel. But if either the *Head* or *Foot drive-out* the two Sides of the thicknesses are not parallel; and must therefore be mended.

Next, he considers whether the sides of the *Body* be straight, first by laying two Letters with their *Nicks* upwards upon one another, and holding them up in his Fingers, between his Eye and the Light, tries if he can see Light between them: For if the least Light appear between them, the *Carriage* is not straight. Then he lays the *Nicks* against one another, and holds them also against the Light, as before: Then he lays both the *Nicks* outward, and examines them that way, that he may find whether either or both of the *Carriages* are out of straight.

But we will suppose now the *Body* somewhat too big, and that it drives out at the *Head* or *Foot*; and that the thickness *drives-out* at the *Head* or *Foot* and that the Sides of the *Body* are not straight. These are Faults enough to take the *Mold* asunder: but yet if there were but one of these Faults it must be taken asunder for that; by unscrewing the *Male-Gage*, to take the *Body* off the *Carriage*, and the *Carriage* off the *Bottom-Plate*.

Having found where the Fault of one or both sides of the *Body* is, he lays the *Body* down upon the *Using File*; and if the Fault be extuberant, he rubs the
Extu-

Extuberancy down, by preſſing his Finger or Fingers hard upon the oppoſite ſide of the Body, juſt over the extuberant part; and ſo rubbing the Body hard forwards on the *Uſing-File*, and drawing it lightly backwards, he rubs till he has wrought down the extuberancy, which he examines by applying the *Lyner* to that ſide of the Body, and holding it ſo up between his Eye and the Light, tries whether or not the *Lyner* ride upon the part that was extuberant; which if it do, the extuberancy is not ſufficiently rub'd off, and the former Proceſs muſt again begin and be continued till the extuberancy be rub'd off. And if the Body were too big, he by this Operation works it down: Becauſe the extuberancy of the *Body* rid upon the *Carriage*, and bore it up.

And if the fault be a *Dawk*, or Hollow in the *Body*, then he Works the reſt of that ſide of the *Body* down to the bottom of the *Dawk*, which by applying the *Lyner* (as afore) he tries, and this alſo leſſens the *Body*.

If the *Body* drive-out at *Head* or *Foot*, he lays the weight of his Fingers heavy at that ſide or end of the *Body* which is too thick, and ſo rubs that down harder.

If the thickneſs of the Letter, drive-out at *Head*, or *Foot*, he Screws the *Body* into the *Vice*, and with a flat ſharp *File*, files the *Side* down at the *Head*, or *Foot*. At the ſame time, if the *Shanck* of the Letter be not Square, he mends that alſo, and ſmooth-files it very well.

Then

Then he puts the *Mold* together again: And melting, (or laying aside) his first *Proofs*, lest they should make him mistake, he again *Casts* about twenty New *Proofs*, and examines by them as before, how well he has mended the *Body*, and how near he has brought the *Body* to the size of the *Pattern*: For he does not expect to do it the *First*, *Second*, or *Seventh* time; but mends on, on, on, by a little at a time, till at last it is so finisht.

If the *Body* prove too small, it is underlaid with a thick or a thin *Affidue*; or sometimes a thin *Plate* of *Brass*.

Then he examines the *Mouth-piece*, and sees that the *Jaws* slide exactly true, upon every part of the *Pallat* without riding.

If the *Throat* of the *Mouth-piece* lie too low, as most commonly it is designed so to do; Then a *Plate* of *Brass* of a proper thickness is laid under it to raise it higher.

He also Justifies the *Registers*, making their *Cheeks* truly Square. And Screwing them about an n from the Corner of the *Body*.

He tries that the *Male* and *Female-Gages* fit each other exactly, and lie directly straight along, and parallel to both the Sides of the *Carriage*.

All this thus performed he needs not (perhaps) take the *Mold* asunder again. But not having yet consider'd, or examin'd the length of the *Shanck* of the Letter, he now does; and if it be somewhat too long (as we will suppose by forecast it is) then the *Body* and *Carriage* being Screwed together, and both the Halves fitted in their *Gages*, the Edges of the
Carri-

Carriage and *Body* are thus together rub'd upon the *Ufing-File*, till the *Carriage* be brought to an exact length.

Having thus (as he hopes) finisht the justifying of the *Mold*; and put it together, and Screwed it fast up, he puts the two Halves together, and then Rubs or Slides them hard against one another, to try if he can perceive any little part of the *Body* Ride upon the *Carriage*, or *Carriage* ride upon the *Body*: To know which of them it is that Rides, or is extuberant, he uses the *Liner*; applying it to both the Places, as well of the *Body* as the *Carriage*: where he sees they have Rub'd or bore upon one another: And which of them that is extuberant, the Edge of the *Liner* will shew, by Riding upon it: And that part he Files upon with a small flat and very fine *File*, by little and little, taking off the extuberancy, till the *Bodies* and *Carriages* lie exactly flat upon, and close to one another: Which if they do not, the *Mold* will be sure to *Rag*.

§. XVII. ¶ I. *Of Sinking the Punches into the Matrices.*

THAT the *Matrice*, and all its parts may be the better understood, as I shall have Occasion to Name them, I have given you a *Draft* of the *Matrice* in Plate, 18 at E. and shall here explain its parts.

E The *Matrice*, wherein is Punched E, the *Face* of the *Letter*.

a The *Bottom* of the *Matrice*.

b The *Top* of the *Matrice*.

c The

c The *Right Side* of the *Matrice*.

d The *Left Side* of the *Matrice*.

f g The *Face* of the *Matrice*.

h i The *Leather Grove* of the *Matrice*.

In the *Back* or *Side* behind the *Matrice*, juſt behind *E* is filed in athwart the *Back*, from the right to the left *Side* a *Notch*, to ſettle and hold the point of the *Spring* or *Wyer* of the *Mold* in, that the *Matrice* fly or ſtart not back when it is at *Work*.

As I told you (in §. 11. ¶ 1.) that the *Punches* are to be made of ſeveral *Thickneſſes*, for reaſons there ſhewed; and that therefore the *Letter-Cutter* makes *Wooden Patterns* for his ſeveral *Sizes* of *Thickneſſes* as well as *Heights*; ſo now I am come to the *Sinking* of the *Punches* into the *Matrices*, I muſt tell you again that the *Letter-Cutter* or elſe the *Founder*, (either of which that *Sinks* them; for ſometimes it is a *Task Incumbent* on each of them) conſiders the *Thickneſſes* of all the *Punches* he has to *Sink*, though *Heighth* he need not conſider in *Sinking* the *Matrices*: For the *Matrices*, by reaſon of their length in *Copper* upwards and downwards, have *Subſtance* enough and to ſpare, for the longeſt *Letters* to be *Sunk* into them: Therefore I ſay, he only conſiders the ſeveral *Thickneſſes* of all the *Punches*, and makes *Wooden Patterns* for them, marking with a *Pen* and *Inck* the number of each ſize, on the *Pattern* as before he did for the *Steel-Punches*: But the *Patterns* he made for the *Steel Punches* will be too *Thin* for the *Copper Matrices*: Becauſe the *Steel Punches* by *Sinking* into the *Matrices*, ſtretch and force the *Sides* of the *Copper* out, and ſometimes crack them for want of *Subſtance*

stance; and at other times carry or force the Substance of the *Matrice* so low with their *Sholder* if the *Letter* be broad, that it creates a great Trouble to rub them *Flat*, (as it is called) because it is done upon the *Ufing-File*.

Therefore he makes *Wooden Patterns* for every of the former siz'd *Punches*, so thick or rather an n thicker at the least, then he made the *Wooden Patterns*, that the *Steel-Punches* were made to be *Forged* by, that there may be Substance enough on each-side the *Copper* to bear the dilating that the sinking of the *Punch* into it will make, because the *Counter-Puncht-Letters* are Thicker by their *Stems* and *Footing* or *Topping* than the *Counter-Punches* made for them need be.

Therefore (as before) for three sizes of *Punches* to be *Counter-Puncht*, he made three several siz'd *Patterns*; so now for the several siz'd *Punches* that are to be *Sunk* into *Matrices*, he makes three several siz'd *Patterns* of *Wood* for the *Copper-Smith* to draw out *Rods* of *Copper* of those several Sizes by, and each of them (as aforesaid) an n, and for the Thick *Letters* an m (at least) Thicker than the *Patterns* were made, for the *Steel-Punches* to be *Forged* to a size by.

In the Forging of these *Copper Rods*, he instructs the *Copper-Smith* to make Choice of the softest *Copper* he can get, that the *Steel-Punches* may run the less hazzard of breaking; and sometimes (if too soft Temper'd) battering their Stroaks.

The *Rose Copper* is commonly accounted the softest:
But

But yet I have many times *Sunk Punches* indifferently into every sort of *Copper*. Nay, even cast *Copper*, which is generally accounted the Hardest: Because *Copper*, as well (as some other Mettals) Hardens with Melting.

These *Rods* of *Copper* are (as I told you in §. III. ¶ 1. to be Cut into small Lengths, each about an Inch and an half long, and a *Great-Primmer* or *Double-Pica* deep; and for great Bodied *Letters* a *Two-lin'd-English* deep; But their Thickness not assignable, because of the Different Thicknesses in *Letters*, both of the same and other *Bodies*, as in part I shewed, in §. II. and more fully in this present §. and ¶.

The reason why the *Copper-Rods* are Forg'd so deep, is, That the more substance of *Copper* may lie under the *Face* of the *Punch*: For if the *Rod* have not a convenient depth, the *Face* of the *Punch* in *Sinking*, does the sooner ingage with the Hardness of the *Face* of the *Stake* it is *Sunk* upon: And having with a few Blows of the *Hammer*, soon hardned the *Copper* just under the *Face* of the *Punch*, as well the hardness of the small (thus hardned) *Body* of *Copper* just under the *Face* of the *Punch*, as the Hardness of the *Face* of the *Stake* contribute a complicated assistance to the breaking or battering the *Face* of the *Punch*. But if the *Rod* be deep, the Substance of *Copper* between the *Face* of the *Punch* and the *Stake* is less hardned, and consequently the *Punch* will *Sink* the easier, and deeper with less Violence.

But

But sometimes it has happ'ned that for the *Sinking* one *Matrice* or two, I have been loath to trouble my self to go to the *Copper-Smiths*, to get one Forged: and therefore I have made shift with such *Copper* as I have had by me. But when it has not been so deep as I could have wisht it, I have just entered the *Punch* into the *Matrice* upon the *Stake*, and to *Sink* it deep enough, I have laid it upon a good thick piece of *Lead*, which by reason of its softness has not hardened the *Copper* just under the *Face* of the *Punch*; but suffered the *Punch* to do its *Office* with good Success.

Having cut the *Copper-Rods*, into fit Lengths with a Cold *Chissel*, He files the end that is to stand upon the *Stool* of the *Mold* exactly square, and the Right-side of the *Matrice*, that stands against the *Carriage* and *Body*, also exactly Square and smooth upon the *Ufing-File*. Then he places the filed end, or *Bottom* upon the *Stool*, with the *Face* of the *Matrice* towards the *Carriage* and *Body*, and the Right side of the *Matrice*, close against the *Register*: Then if the *Punch* to be sunk be an ascending Letter. He with a fine pointed *Needle*, makes a small Race by the upper side of the *Carriage* upon the *Face* of the *Matrice*, and that Race is a mark for him, to set the top of the Ascending *Letter* at, when he *Sinks* it into the *Matrice*: So that then placing the *Punch* upright upon the middle of the Thickness of the *Matrice*, the *Matrice* lying solid on the *Stake*: He with the *Face* of an *Hammer* fizable to the bigness of his *Punch*, cautiously knocks upon the *Hammer-end* of the *Punch*, with reiterated Blows, till he

he have driven the *Punch* deep enough into the *Matrice*.

But if it be a short *Letter*, or a Descending *Letter*, and not Ascending alfo: Then he elects any *Cast-Letter* of the Thicknefs of the *Beard*, (as *Founders* and *Printers* call it) For which Explanation fee the Table, and he lays that *Letter* upon the *Surface* of the *Carriage*, and then placing the *Bottom* of the *Matrice* to be *Sunk* as before, on the *Stool*, and againft the *Register*, He draws with a *Needle* as before, a race above the *Surface* of that *Letter*, againft the *Face* of the *Matrice*, and that race is a Mark for him to place the *Head* of the *Letter* by. Then managing the *Punch* and *Hammer* as before was fhewed, he *Sinks* the *Punch* into the *Matrice*.

But here arifes a Question, *viz.* How deep the *Punches* are to be *Sunk* into the *Matrices*? The Answer is, a Thick *Space* deep, though deeper even to an *n* would be yet better: Becauſe the deeper the *Punches* are *Sunk*, the lower does the *Beards* ſtand below the *Face*, and thoſe *Beards* when the *Cast Letter* comes into the *Printers* Hands to be uſed, are the leſs ſubject to *Print*, as too oft they do both at *Head* or *Foot* of a *Page*, than when they lie ſo high that the ſoftnefs of the *Blankets*, and Hardnefs of a *Pull*, or elſe careleſnefs of Running the *Carriage* of the *Preſs* to a conſidered Mark they would be. But they are ſeldom *Sunk* any deeper then a thick *Space*: and the reaſon is, becauſe the breaking or battering the *Face* of the *Punch* ſhould not be to much hazarded.

The

The many *Punches* to be *Sunk* into *Matrices* for the same *Body*, are difficult to be *Sunk* of an equal depth. Therefore I always make a *Beard-Gage*, as is described in *Plate 19* at *F*, where *a b* is a *Sholder* that rests upon the *Face* of the *Matrice*, *c* is the *Point* or *Gage* that measures the depth of the *Sunken Punch*. So that when the *Point c* just touches the *Bottom*, and both the *Sholders a b* the *Face* of the *Matrice*, the *Punch* may be accounted well *Sunk* as to depth.

But though it be accounted well *Sunk* for a first Essay, yet can it not be reasonably imagined it is well *Sunk* for good and all; as well because in *Sinking* the *Punches* it has carryed some part of the *Surface* of the *Matrice* down below the *Face* of the *Matrice* into the *Body* of the *Copper*, as because both the *Sides* are doubtless extorted, and one Side or Part of the *Punch Sunk* more or less deeper than the other. Wherefore I now come to

¶ 2. *Justifying the Matrices.*

Justifying of Matrices is, 1. to make the *Face* of the *Sunken Letter*, lie an exact designed depth below the *Face* of the *Matrice*, and on all its sides equally deep from the *Face* of the *Matrice*. 2. It is to set or *Justifie* the *Foot-line* of the *Letter* exactly in *Line*. 3. It is to *Justifie* both the sides, viz. the *Right* and *left-sides* of a *Matrice* to an exact thickness.

Therefore to proceed Methodically, he first slightly Files down the *Bunchings* out that the *Punch* made

made in the Sides of the *Matrice*; And then slightly Files down all the *Copper*, on the *Face* of the *Matrice*, till the Hollow the *Punch* made becomes even with the whole *Face* of the *Matrice*.

Then he *Cast*s a *Proof-Letter* or two, and *Rubs* them: And with the Edge of a Knife cuts out what may remain in the bottom of the *Shanck* by reason of the un-even breaking, off of the *Break* that the square bottom of the *Shanck* may not be born off the *Bottom-Ledge* of the *Lining-Stick*.

But having till now said nothing of the *Lining-Stick*, it is proper before I proceed, to give a Description of it: It is delineated in *Plate 19* at G. Where G is the *Plain*, *a* the *Side-Ledge*, *b* the *Bottom-Ledge*, *c* the *Stilt*, all made of *Brass*s.

The *Plain* is exactly Flat, Straight, and Smooth, that the *Shancks* of the *Letter* being likewise so, may lie flat and solidly on it. Its depth between the *Bottom-Ledge*, and the fore edge is about the length of the *Shanck* of the *Letter*: But the whole *Plain* of *Brass*s is yet deeper; Because the *Bottom-Ledge* is fastened on it. The *Lining-Stick* is about two *Inches* long for small *Letters*; but longer for *Big-Bodied Letters*.

Both *Bottom* and *Side-Ledge*, is a thin piece of *Brass*s, from a *Scaboard* to a *Pica* thick, according as the *Body* whose *Face* and *Foot-line* is to be *Justified* in it is bigger or less. These two *Ledges* is an *Inside Square* exactly wrought, and with small *Rivets* fastened on the *Side* edge, and on the *Bottom* edge.

The

The *Stilt* is a thin flat piece of *Brass-Plate* about a *Scaboard* thick, and a *Double-Pica* broad: One of its edges is *Soldered* to the under-side of the *Plain*, about a *Double-Pica* within the fore-edge of the *Plain*, that the *Lining-Stick* (when set by with *Proof-Letters* in it) may not lie flat on its *Bottom*; but have its fore edge *Tilted* up, that the *Letters* in it may rest against the *Bottom-Ledge*.

Having cut the *Notch* in the *Break* of the *Letters* as aforefaid, He *Rubs* every side of them on the *Stone*, with two or three hard *Rubs*, to take off the small *Rags* that may happen on the *Shanck* of the *Letter*, notwithstanding the *Mold* is imagined to be very truly made and *Justified*.

The *Stone* is commonly a whole *Grind-Stone*, about eighteen Inches diameter, having both its sides truly *Rub'd* flat and smooth, by *Jostling* it (as *Masons* call it) upon another broad long and flat *Stone* with *Sand* and *Water*. It must have a fine, but very sharp *Greet*. Now to return.

He places a *Quadrat* of the same *Body*, on the *Plain* of the *Lining-stick*, and against the *Side-Ledge* of it He sets up three or four old m's of the same *Body*: Then sets up his *Proof-Letter* or *Letters*, and after his *Proof-Letter* three or four old m's more of the same *Body*; and being very careful that the *Foot* of the *Shanck* of the *Letter* stands full down against the *Bottom-Ledge* of the *Lining-stick*, He applies the edge of the *Liner* to the *Faces* of all these *Letters*: And if he finds that the edge of the *Liner* just touch (and no more) as well all the parts of his *Proof-Letters*

ters as they do upon his old *Letters*, He concludes his *Matrice* is *Sunk* to a true *Height againſt Paper*.

But he ſeldom hopes for ſo good luck; but does more likely expect the *Matrice* is *Sunk* too deep or too ſhallow, and awry on the right and left-ſide, or on the top or bottom of the *Line*, for all or any of theſe Faults the *Liner* will eaſily diſcover. Therefore I ſhall ſhew you how he *Juſtifies* a *Matrice* that is too *High againſt Paper*.

We will ſuppoſe the *Face* of the *Punch* is *Sunk* flat and ſtraight down into the *Matrice*; but yet it is a little too deep *Sunk*. Therefore he conſiders how much it is too deep: If it be but a little too deep, perhaps when the *Face* of the *Matrice* ſhall be made exactly flat (for yet it is but *Rough-Filed*) it may be wrought down to be juſt of an *Height againſt Paper*. But if the *Punch* be *Sunk* ſo much too deep that the ſmoothing the flat of the *Face* on the *Uſing-File* will not work it low enough; then with a *Baſtard-cut flat-File*, he takes off (according to his Diſcretion) ſo much *Copper* from the *Face* of the *Matrice* as will make it ſo much nearer as he thinks it wants to the *Face* of the Letter. But yet conſiders that the *Face* of the *Matrice* is yet to ſmoothen on the *Uſing-File*, and therefore he is careful not to take too much off the *Face* of the *Matrice* with the *Rough-File*.

He is alſo very careful that when he is to *File* upon the *Face* of the *Matrice*, to *Screw* the *Face* of it Horizontally flat in the *Vice*: And that in *Filing* upon it, he keeps his *File* directly Horizontal, as
was

was shewed, *Numb.* 1. *Fol.* 15, 16. *Vol.* 1. For if he let his right or left-Hand dip, the *File* will in its Natural Progress take too much off the side it dips upon, and consequently the *Face* of the Letter on that side will lie shallower from the *Face* of the *Matrice* then it will on the opposite side. The like caution he makes, in *Filing* between the *Top* and *Bottom* of the *Matrice* on the *Face*. For if he *Files* away too much *Copper* toward the *Top* or *Bottom*, the *Face* of the *Letter* on its *Top* or *Bottom-Line*, will lie on that end shallower from the *Face* of the *Matrice*.

Then he considers by his *Proof-Letters* how much too thick the right or left side of the *Matrice* is.

I told you in § 11. ¶ 4. that the Angle the *Sholder* made with the *Face* of the *Letter*, is about 100 Degrees, which is 10 Degrees more then a *right Angle* or *Square*. So that if a *Letter* be *Cast* and *Rub'd* just so thick that the *Liner* when applied to the *Shanck* of the *Letter* reaches just to the *Sholder*, there will be an *Angle* of 10 Degrees, contained between the edge of the *Liner* and the *Straight Line* that proceeds from the *Sholder* at the *Shanck*, to the outer-edge of the *Face* of the *Letter*. And if two *Letters* be thus *Cast* and *Rub'd* and *Set* together, the *Angle* contained between their *Shancks*, and the outer-edge of the *Face* of the *Letter* will be 20 Degrees, which is too wide by half for the *Faces* of two *Letters* to stand assunder. Therefore the sides of the *Matrice* must be so *Justified*, that when the *Shancks* of two *Letters* stand close together, the *Angle* between

tween both the *Shancks*, and the adjacent outer-edges of the *Faces* of the *Letters* may both make an *Angle* of about 10 Degrees as aforefaid, which is a convenient diftance for two *Letters* to ftand affunder at the *Face*. But to do which, If the right-fide be too thick, the *Register* of the under-half of the *Mold*, being (as I faid) hard ſcrew'd, ſo as to ftand about an n off the edge of the *Body* towards the right hand; He places the *Foot* of the *Matrice* on the *Stool*, and the right-fide of the *Matrice* cloſe againſt the *Register*, and obſerves how much too thick that fide of the *Matrice* is: For ſo much as the right-hand edge of the *Orifice* of the *Matrice* ftands on the left hand fide of the *Body*, ſo much is the right fide of the *Matrice* too thick, and muſt by ſeveral offers be *Filed* away with a *Baſtard-Cut-File*, not all at once, leaſt (ere he be aware) he makes that fide of the *Matrice* too thin, which will be a great damage to the *Matrice*, and cannot be mended but with a *Botch*, as ſhall in proper place be ſhewed.

Having by ſeveral proffers wrought the right-fide of the *Matrice* thus near its thickneſs, he proceeds to *Juſtifie* the left-fide alſo. But this fide muſt be *Juſtified* by the upper half of the *Mold*; By turning the top of the *Matrice* downwards, and placing the left-fide of it (now the right-fide) againſt the *Register*, and works away the left-fide in all reſpects as he did the right-fide; ſtill being very cautious he takes not to much *Copper* away at once.

To *Juſtifie* the *Letter* in *Line* he examines the *Proof-Letter* (yet ſtanding in the *Lining-Stick*) and applies the
the

the *Liner* to the *Foot-line*: And if the *Liner* touch all the way upon the *Foot-line* of the *Proof-Letter* and the *Foot-Line* of all the old m's, that *Matrice* is *Justified* in *Line*. But this also very rarely happens at first, for by design it is generally made to stand too low in *Line*: Because the *Bottom* of the *Matrice* may by several proffers be *Filed* away till the *Letter* stand exactly in *Line*. But should he take too much off the *Bottom* of the *Matrice*, it cannot be made to stand lower without another *Botch*.

Nor does he reckon that this first Operation, or perhaps several more such, shall *Justifie* the *Matrice* in *Line*. But after bringing both the sides of the *Matrice* thus near, and also bringing the *Matrice* thus near the *Line*. He *Cast*s another *Proof-Letter* or two, and *Rubbing* all the sides of their *Shancks*, as before was shew'd, he tries by *Rubbing* the *Letters* how near he has brought the thickness of both the sides: For when the sides of the *Matrice* are brought just to such a thickness, that the *Shanck* of the *Letter* (*Cast* in the *Mold*) *Rubs* flat half way up beyond the *Beard* towards the *Face* of the *Letter*, the *Matrice* is of a convenient thickness, and there the *Angle* from the *Beard* of the *Shanck*, to the outer-edge of two *Letters* set together, will make an *Angle* of about 10 degrees as aforesaid, which being about one third part of a *thin-Space* is a convenient distance for the adjacent edges of two *Letters* to stand assunder: But yet *Founders* sometimes to *Get in* or *Drive out*, *Cast* the *Letters* thinner or thicker, and consequently their *Faces* stand closer or wider assunder

der, which is unfeemly when the *Letter* comes to be *Printed*.

Then he sets the *Proof-Letters* in the *Lining-Stick*, between four or five old m's as before, and with the *Liner* examines again how well these *Proof-Letters* stand in *Line* with the old m's, which if they do not, he Reiterates the former Operations so oft, till the sides and *Line* of the *Matrice* is *Justified*, and at every Operation *Casts* new *Proof-Letters* to examine the thickness of both the Sides, and how well the *Matrice* is *Justified* to *Stand in Line*.

The *Matrice* being now *Justified*, he *Files* a *Leather-Groove* round about it, viz a *Notch* (made properest with a three square *File*) within about a thick *Scaboard* of the top of the *Matrice*, to tie the *Leather* fast to.

He also *Files* another *Notch* in the back-side of the *Matrice* athwart it, to rest the point of the *Wyer* or *Spring* in. But this *Notch* must by no means be made before the *Matrice* be *Justified* to its true *Height against Paper*: Because when this *Notch* is made, the *Punch* cannot again be struck in the *Matrice*; For that the *Matrice* will not lie solid on the *Stake* in that place.

¶ 3. Of Botching-Matrices, to make them
serve the better.

Matrices are sometimes either through a careless, or sometimes through an unlucky stroke or two of the *File* made too thin. And sometimes the *Foot* of the *Matrice* is too much taken away, and the *Letter* by that

that means stands too high in *Line*: And sometimes the *Face* of the *Matrices* is too much taken away; So that the Letter will not stand *High enough against Paper*.

To remedy all or any part of these inconveniences, *Founders* are forced to make *Botches* on the *Matrice*: As first, If the *Matrice* be too thin on the right or left side, or both; They prick up that side, by laying the *Matrice* flat on the *Work-Bench*, with the thin side upwards, and holding the point of a *Punch-Graver* alope upon the thin side, with an *Hammer* drive the point into the thin side of the *Matrice*, and so raise a *Bur* upon that side; which *Bur* (though it thicken not the *Matrice*, yet it) makes the side of the *Matrice* stand off the *Register*, and consequently is equivalent to thickning it.

The higher this *Bur* is raised, the better is the *Matrice Botcht*; because the thin fine points thus raised (if not pretty well flatted into the Substance of the *Bur*) will quickly either wear off by the pressure of the *Register* against them, or else flatten into the *Body* of the *Bur*, and both ways makes the *Matrice* again too thin.

Sometimes they do not *Botch* the *Matrice* thus for this fault; but only Paste a piece of Paper, or a Card, (according as it may want thickness) against the thin side of the *Matrice* and so thicken it.

But to mend the sides I use another Expedient, viz. by Soldering a piece of *Plate-Brafs* against its thin side or sides, which is much better than *Botching* it.

Second-

Secondly, If the *Matrice* be filed away too much at the *Foot*, they knock it up with the *Pen* of the *Hammer*; and stretch it between the *Foot* and the *Orifice* of the *Matrice*, and then *Justifie* it again in *Line*. Or a piece may be *Soldered* under the *Foot*.

Thirdly, If the *Face* of the *Matrice* be too much taken away, and either the *Punch* spoiled or the *Notch* in the back of the *Matrice* made so, as it cannot be *Sunken* deeper, they raise a *Bur* on the *Face*, as they did on the thin sides, to keep the *Matrice* off the *Carriages* and *Bodies* which Lengthens the height of the Letter *against Paper* so much as is the height of the raised *Bur*. But of all the *Botches* this is the worst, because the *Beard* lies now nearer the *Face*: And the hollow standing off of the *Face* of the *Matrice* from the *Carriages* and *Bodies*, subjects the *Mettal* to run between them, and so pesters the Workman to get the Letter out of the *Mold* and *Matrice*.

Sect. XVIII, *Of setting up the Furnance.*

HAVING *Justified* the *Mold* and *Matrice*, we come now to *Casting of Letters*: But yet we have neither *Furnance*, *Mettal*, or *Ladle*. Wherefore it is the *Founders* care, first to provide these.

The *Furnance* I have described in Plate 20. It is built of Brick upright, with four square sides and a Stone on the top, in which Stone is a wide round hole for the *Pan* to stand in.

a b c d The

a b c d The square Stone at the top, covering the whole *Furnance*. This is indeed the *Furnance*.

a d, b c The breadth two Foot and one Inch.

a b, c d The Length two Foot three Inches. Into the Breadth and Length about the whole Stone, is let in even with the top of the Stone a square *Iron Band* two Inches deep, and a quarter and half quarter of an Inch thick to preserve the Edges of the Stone from battering.

e The round hole the *Pan* stands in, which hath an *Iron Plate* let into it eight Inches diameter, an Inch and half broad and one quarter of an Inch thick.

This *Iron-Plate* fits the *inside* of the *Hole* so far as it is Circular, and consequently is a *Segment* of a *Circle*. But where the *Smoak-vent* breaks off the Circularity of the Stone, there ends this Plate of *Iron*, that the *Smoak* may have the freer vent. Its Office also is to preserve the Edge of the *Hole* from battering, with the oft taking out and putting in the *Iron Pan*.

f The *Funnel* seven Inches high, and five Inches wide.

g The *Stoke-Hole* four Inches wide, and six Inches long.

h h The height of the *Furnance* two Foot ten Inches.

i The *Air-Hole* just underneath the *Hearth* to let in Air that the Fire may burn the freer.

k The *Ash-Hole* where the *Ashes* that fall from the *Hearth* are taken away.

l m n o The

l m n o The *Bench* two Foot broad, three Foot long, and two Foot eight Inches high. The *Bench* is to empty the Letters out of the *Mold* upon, as the *Founder* *Cafts* them.

The *Hearth* lies seven Inches below the top of the round *Hole*, and hath under it another round *Iron-Ring* of the ſame demenſions with the firſt, on which ſtraight *Iron-Bars* are faſtened that the *Fire* is laid on.

In the round *Iron-Ring* (or rather Segment) on the top of the *Furnance* is ſet the *Pan*, which is either a *Plate Ladle*, or a ſmall *Caſt-Iron Kettle* that ſinks into it within two Inches of the *Brim*s of the *Pan*.

¶ 2. Of making Mettal.

The *Mettal Founders* make *Printing Letters* of, is *Lead* hardned with *Iron*: Thus they chuſe *ſtub-Nails* for the beſt *Iron* to Melt, as well becauſe they are aſſured *ſtub-Nails* are made of good ſoft and tough *Iron*, as becauſe (they being in ſmall pieces of *Iron*) will Melt the ſooner.

To make the *Iron Run*, they mingle an equal weight of *Antimony* (beaten in an *Iron-Morter* into ſmall pieces) and *ſtub-Nails* together. And preparing ſo many Earthen forty or fifty pounds *Melting-Pots* (made for that purpoſe to endure the *Fire*) as they intend to uſe: They *Charge* theſe Pots with the mingled *Iron* and *Antimony* as full as they will hold.

Every

Every time they Melt *Mettal*, they build a new *Furnance* to melt it in: This *Furnance* is called an *Open Furnance*; because the Air blows in through all its sides to Fan the *Fire*: They make it of Bricks in a broad open place, as well because the Air may have free access to all its sides, as that the Vapours of the *Antimony* (which are Obnoxious) may the less offend those that officiate at the *Making* the *Mettal*: And also because the Violent Fire made in the *Furnance* should not endanger the Firing any adjacent Houses.

They consider before they make the *Furnance* how many Pots of *Mettal* they intend to Melt, and make the *Furnance* fizable to that number: We will suppose *five Pots*. Therefore they first make a Circle on the Ground capable to hold these five *Pots*, and wider yet by three or four Inches round about: Then within this Circle they lay a Course of Bricks close to one another to fill the Plain of that Platform, with their broad or flat sides downwards, and their ends all one way, and on this Course of Bricks they lay another Course of Bricks as before, only the Lengths of this Course of Bricks lies athwart the Breadths of the other Course of Bricks: Then they lay a third Course of Bricks with their lengths cross the Breadth of the second Course of Bricks.

Having thus raised a Platform, they place these five *Pots* in the middle of it close to one another, and then on the Foundation or Plat-form raise the *Furnance* round about by laying the Bricks of the first *Lay* end to end and flat, close to one another:
On

On the fecond *Lay*, they place the middle of a Brick over a *Joynt* (as *Brick-layers* call it) that is where the ends of two Bricks joyn together, and fo again lay Bricks end to end till they *Trim* round the *Platform*. Then they lay a third *Lay* of Bricks, covering the *Joynts* of the fecond *Lay* of Bricks as before: So is the Foundation finift.

Then they raife the Walls to the *Furnance* on this Foundation; But do not lay the ends of their Bricks clofe together. But lay the ends of each Brick about three Inches off each other, to ferve for *Wind-holes* till they *Trim* round about: Then they lay another *Lay* of Briks leaving other fuch *Wind-holes* over the middle of the laft *Lay* of Bricks, and fo *Trim* as they work round either with half Bricks or Bats that the *Wind-holes* of the laft *Lay* may be covered: And in this manner and order they lay fo many *Lays* till the Walls of the *Furnance* be raifed about three Bricks higher than the *Mouths* of the *Melting-Pots*, ftill obferving to leave fuch *Wind-holes* over the middle of every Brick that lies under each *Lay*.

Then they fill the fides of the *Furnance* round about the *Melting-Pots*, and over them with *Char-coal*, and *Fire* it at feveral *Wind-holes* in the bottom till it burn up and all over the *Furnance*, which a moderate Wind in about an Hours time will do: And about half an Hours time after they lay their Ears near the Ground and liften to hear a *Bubling* in the *Pots*; and this they do fo often till they do hear it. When they hear this *Bubling*, they conclude the *Iron* is melted: But yet they will let it ftand, perhaps half an hour longer or more, according as they guefs
the

the Fire to be Hotter or Cooler, that they may be the more assured it is all thoroughly Melted. And when it is Melted the Melting *Pot* will not be a quarter full.

And in or against that time they make another small *Furnance* close to the first, (to set an *Iron Pot* in, in which they Melt *Lead*) on that side from whence the Wind blows; Because the Person that Lades the *Lead* out of the *Iron-Pot* (as shall be shewed by and by) may be the less annoyed with the Fumes of the *Mettal*, in both *Furnances*. This *Furnance* is made of three or four *Course* of Bricks open to the windward, and wide enough to contain the designed *Iron Pot*, with room between it and the sides to hold a convenient quantity of *Charcoal* under it, and about it.

Into this *Iron-Pot* they put for every three Pound of *Iron*, about five and twenty pounds of *Lead*. And setting Fire to the *Coals* in this little *Furnance* they Melt and Heat this *Lead* Red-hot.

Hitherto a Man (nay, a Boy) might officiate all this Work; But now comes Labour would make *Hercules* sweat. Now they fall to pulling down so much of the side of the open *Furnance* as stands above the Mouth of that *Melting-Pot* next the *Iron-Pot*, And having a thick strong *Iron Ladle*, whose *Handle* is about two Yards long, and the *Ladle* big enough to hold about ten Pounds of *Lead*, and this *Ladle* Red-hot that it chill not the *Mettal*, they now I say with this *Ladle* fall to clearing this first *Melting-Pot* of all the *Coals* or filth that lie on the top of the Melted *Mettal*: while another Man at the same time stand

ftands provided with a long ftiong round *Iron Stirring Poot*; the *Handle* of which *Stirring Poot* is alfo about two Yards long or more, and the *Poot* it felf almoft twice the length of the depth of the Melting *Pot*. This *Poot* is nothing but a piece of the fame *Iron* turned to a fquare with the *Handle*: And this *Poot* is alfo in a readinefs heated Red-hot.

Now one Man with the *Ladle Lades* the *Lead* out of the *Iron-Pot* into the Melting *Pot*, while the other Man with the *Poot* ftirs and Labours the *Lead* and *Mettal* in the Melting *Pot* together till they think the *Lead* and *Mettal* in the Melting *Pot* be well incorporated: And thus they continue *Lading* and *Stirring* till they have near filled the Melting *Pot*.

Then they go to another next *Melting-Pot*, and fucceffively to all, and Lade and ftir *Lead* into them as they did into the firft. Which done the *Mettal* is made: And they pull down the *Walls* of the *Open Furnance*, and rake away the Fire that the *Mettal* may cool in the *Pots*.

Now (according to Cuftom) is Half a Pint of Sack mingled with Sallad Oyl, provided for each Workman to Drink; intended for an Antidote againft the Poyfonous Fumes of the *Antimony*, and to reftore the Spirits that fo Violent a Fire and Hard Labour may have exhausted.

Plate 20.



¶ 3. Of Letter-Ladles.

Letter-Ladles differ nothing from other common *Ladles*, save in the size: Yet I have given you a Draft of one in Plate 20 at A. Of these the *Caster* has many at Hand, and many of several sizes that he may successively chuse one to fit the several sizes of *Letters* he has to *Cast*; as well in *Bodies* as in *Thicknesses*.

§ XIX. ¶ 1. Of Casting, Breaking, Rubbing, Kerning, and setting up of Letters.

BEfore the *Caster* begins to *Cast* he must kindle his *Fire* in the *Furnance*, to *Melt* the *Mettal* in the *Pan*. Therefore he takes the *Pan* out of the Hole in the Stone, and there lays in *Coals* and kindles them. And when it is well kindled, he sets the *Pan* in again, and puts *Mettal* into it to *Melt*. If it be a small *Bodyed-Letter* he *Cast*s, or a thin *Letter* of Great *Bodies*, his *Mettal* must be very hot; nay, sometimes Red-hot to make the *Letter Come*. Then having chose a *Ladle* that will hold about so much as the *Letter* and *Break* is, he lays it at the *Stoking-hole*, where the Flame bursts out to heat. Then he ties a thin Leather cut into such a Figure as is described in Plate 20 at B with its narrow end against the *Face* to the *Leather-Groove* of the *Matrice*, by whipping a Brown Thred twice about the *Leather-Groove*, and fastning the Thred with a Knot. Then he puts both Halves of the *Mold* together, and puts
the

the *Matrice* into the *Matrice Cheek*, and places the *Foot* of the *Matrice* on the *Stool* of the *Mold*, and the broad end of the *Leather* upon the *Wood* of the upper half of the *Mold*, but not tight up, lest it might hinder the *Foot* of the *Matrice* from *Sinking* close down upon the *Stool* in a train of Work. Then laying a little *Rofin* on the upper *Wood* of the *Mold*, and having his *Castling Ladle* hot, he with the bolting side of it Melts the *Rofin*; And when it is yet *Melted* presses the broad end of the *Leather* hard down on the *Wood*, and so fastens it to the *Wood*. All this is Preparation.

Now he comes to *Castling*. Wherefore placing the under-half of the *Mold* in his left hand, with the *Hook* or *Hag* forward, he clutches the ends of its *Wood* between the lower part of the *Ball* of his Thumb and his three hind-Fingers. Then he lays the upper half the *Mold* upon the under half, so as the *Male-Gages* may fall into the *Female-Gages*, and at the same time the *Foot* of the *Matrice* place it self upon the *Stool*. And clasping his left-hand Thumb strong over the upper half of the *Mold*, he nimbly catches hold of the *Bow* or *Spring* with his right-hand Fingers at the top of it, and his Thumb under it, and places the point of it against the middle of the *Notch* in the backside of the *Matrice*, pressing it as well forwards towards the *Mold*, as downwards by the *Sholder* of the *Notch* close upon the *Stool*, while at the same time with his hinder-Fingers as aforesaid, he draws the under-half of the *Mold* towards the *Ball* of his Thumb, and thrusts by the *Ball* of his Thumb the upper part towards his Fingers,

gers, that both the *Registers* of the *Mold* may press against both sides of the *Matrice*, and his Thumb and Fingers press both Halves of the *Mold* close together.

Then he takes the Handle of his *Ladle* in his right Hand, and with the *Boll* of it gives a stroak two or three outwards upon the *Surface* of the *Melted Mettal* to scum or cleer it from the Film or Dust that may swim upon it. Then takes up the *Ladle* full of *Mettal*, and having his *Mold* as aforesaid in his left hand, he a little twists the left-side of his *Body* from the *Furnance*, and brings the *Geat* of his *Ladle* (full of *Mettal*) to the *Mouth* of the *Mold*, and twists the upper part of his right-hand towards him to turn the *Mettal* into it, while at the same moment of Time he Jilts the *Mold* in his left hand forwards to receive the *Mettal* with a strong *Shake* (as it is call'd) not only into the *Bodies* of the *Mold*, but while the *Mettal* is yet hot, running swift and strongly into the very *Face* of the *Matrice* to receive its perfect Form there, as well as in the *Shanck*.

Then he takes the upper half of the *Mold* off the under half, by placing his right-Hand Thumb on the end of the *Wood* next his left-Hand Thumb, and his two middle Fingers at the other end of the *Wood*, and finding the Letter and *Break* lie in the under-Half of the *Mold* (as most commonly by reason of its weight it does) he throws or tosses the Letter *Break* and all upon a Sheet of Waste Paper laid for that purpose on the *Bench* just a little beyond his left-hand, and is then ready to *Cast* another Letter as before,

fore, and alfo the whole number that is to be *Caft* with that *Matrice*.

But fometimes it happens that by a *Shake*, or too big a *Ladle*, the *Mettal* may fpill or flabber over the *Mouth* of the upper Half of the *Mold*, fo that the fpilt *Mettal* fticking about the out-fides of the *Mouth*, may lift the Letter off the under half of the *Mold*, and keep it in the upper half. Therefore he with the point of the *Hag* in the Wood of the under half of the *Mold*, picks at the hollow in the fore part of the *Break* made by the *Shaking* out of the *Mettal*, and draws *Break* and *Letter* both out. It fometimes fticks in the under Half of the *Mold* by the fame caufe, and then he uſes the point of the *Hag* in the upper half of the *Mold*, to pick or hale it out, as before.

It alfo fometimes fticks when any of the Joynts of the *Mold* open never fo little, the *Mettal* thus getting in between thoſe Joynts: But this fault is not to be indured, for before he can *Caft* any more, this fault muſt be mended.

But beſides *Letters*, there is to be *Caft* for a perfect *Fount* (properly a Fund) *Spaces* Thick and Thin, n *Quadrats*, m *Quadrats* and *Quadrats*. Theſe are not *Caft* with *Matrices* but with *Stops* (as we may call them) Becauſe when theſe are *Caft* they are all ſhorter than the *Shanck* of the Letter, that they may not *Print*. Therefore they take off the *Register* of the under-Half *Mold*, and fit a piece of *Plate-Brafs* about a *Brevier* Thick and a *Brevier* longer than to reach to the edge of the *Body* in the place of the *Register*, and drill a hole in this *Plate-Brafs* right againſt the

the Hole in the *Carriage* that the *Female-Screw* lies in: This Hole is made so wide that the *Male-Screw* which screwed the *Register* close to the *Carriage* and *Body* may enter in at it, and screw this *Plate-Brafs* close to them, as it did the *Register*: Then they make a mark with the point of a *Needle* on the *Plate-Brafs* just against the side of the Edge of the *Body*, and at this mark they double down the end of the *Plate-Brafs* inwards to make a perfect *Square* with the inside of the whole *Plate*. This doubling down is called the *Stop* aforesaid, and must be made just so thick as they design the Thin or Thick *Space* to be, and must have its Upper and Under-Edges filed so exactly to the *Body*, that it may lie close upon the Under-*Carriage*, and just even so high as the upper-side of the *Body*. So that when the Upper-half of the *Mold* is placed on the under-Half, and *Mettal* Cast in at the *Mouth* (as before) the *Mettal* shall descend no deeper between the two *Bodies* then just to his *Stop*: You must note that this *Stop* must be filed exactly true as to *Body* and *Thickness*: For if it be never so little too big in *Body*, the *Carriage* of the *Mold* will ride upon it and make the *Body* of the *Space* bigger. Or if the *Body* be never so little too little, the Hot *Mettal* will run beyond the *Stop*; both which Miscarriages in making the *Stop*, spoil the *Space*.

If the *Space* be too short, they File the end of the *Stop* shorter.

This *Brevier* thick *Plate* will be thick enough for *Stops* for the Thin or Thick *Spaces* of any *Body* though of *Great-Cannon*, and for the n *Quadrat Stop*
of

of any Body under a *Great Primmer*. And for the *m* *Quadrat Stop* of all to a *Brevier* and all Bodies under it. But for *Stops* that require to be Thicker then a *Brevier*, instead of doubling the *Stop* inwards on the *Plate*, I *Solder* on the in-side of that end of the *Plate* a *Stop* full big enough in Body, and big enough in Thickness for the *Quadrat* I intend to make, and afterwards file and fit the *Stop* exactly as before.

When they *Cast* these *Spaces* or *Quadrats*, this *Stop* is always screwed fast upon the *Carriage* of the under-Half *Mold* as aforesaid. So that they only fit the upper half *Mold* on the under, and *Cast* their Number almost twice as quick as they do the Letters in *Matrices*.

It is generally observed by *Work-men* as a Rule, That when they *Cast Quadrats* they *Cast* them exactly to the Thickness of a set Number of m's or *Body*, viz. two m's thick, three m's thick, four m's thick, &c. And therefore the *Stops* aforesaid must all be filed exactly to their several intended thicknesses, The reason is, that when the *Compositer* Indents any Number of Lines, he may have *Quadrats* so exactly *Cast* that he shall not need to *Justifie* them either with *Spaces* or other helps.

¶ 2. *Some Rules and Circumstances to be observed in Casting.*

1. If the Letter be a small *Body*, it requires a Harder *Shake* than a great *Body* does: Or if it be a thin Letter though of a greater *Body*, especially
small

small *i*, being a thin Letter its Tittle will hardly *Come*; So that sometimes the *Caster* is forced to put a little *Block-Tin* into his Mettal, which makes the Mettal Thinner, and consequently have a freer flux to the *Face* of the *Matrice*.

2. He often examines the *Registers* of the *Mold*, by often *Rubbing* a *Cast* Letter: For notwithstanding the *Registers* were carefully *Justified* before, and hard screwed up; yet the constant thrusting of both *Registers* against the sides of the *Matrice*, may and often do force them more or less to drive backwards. Or a fall of one half or both Halfs of the *Mold*, may drive them backwards or forwards: Therefore he examin's, as I said, how they *Rub*, whether too Thick or too Thin. And if he see Cause, mends the *Registers*, as I shew'd § 5. ¶ 2.

Or if the *Matrice* be *Botcht*, as I shew'd you § 5. ¶ 3. then those *Botches* (being only so many fine points rising out of the Body of the *Copper* of the *Matrice*) may with so many reiterated pressures of the *Registers* against them, flatten more and more, and press towards the Body of the *Matrice*, and consequently make the Letter Thinner: Which if it do, this must be mended in the *Matrice* by re-raising it to its due Thickness.

3. He pretty often examin's, as I shew'd in § 5. ¶ 2. how the Letters stand in *Line*: For when great Numbers are *Cast* with one *Matrice*, partly by pressing the point of the *Wyer* against the *Bottom-Sholder* of the *Notch* in the back-side of the *Matrice*, and partly by the softness of the matter of his *Matrice* and hardness of the *Iron-stool*, the *Foot* of the *Matrice* (if
it

it wear not) may batter so much as to put the Letter out of Line. This must be mended with a *Botch*, viz. by knocking up the *Foot* of the *Matrice*, as I shew'd § 5. ¶ 3.

A Work-man will *Cast* about four thousand of these Letters ordinarily in one day.

¶ 3. Of Breaking off Letters.

Breaking off is commonly Boys-work: It is only to *Break* the *Break* from the *Shanck* of the *Letter*. All the care in it is, that he take up the *Letter* by its Thickness, not its *Body* (unless its Thickness be equal to its *Body*) with the fore Finger and Thumb of his right Hand as close to the *Break* as he can, left if when the *Break* be between the fore-Finger and Thumb of his left Hand, the force of *Breaking off* the *Break* should bow the *Shanck* of the *Letter*.

¶ 4. Of Rubbing of Letters.

Rubbing of Letters is also most commonly Boys-work: But when they do it, they provide *Finger-stalls* for the two fore-Fingers of the right-Hand: For else the Skin of their Fingers would quickly rub off with the sharp greet of the Stone. These *Finger-stalls* are made of old *Ball-Leather* or *Pelts* that *Printers* have done with: Then having an heap of one sort of *Letters* lying upon the Stone before them, with the left-Hand they pick up the *Letter* to be *Rub'd*, and lay it down in the *Rubbing* place with
one

one of its sides upwards they clap the Balls of the fore-Finger and middle-Finger upon the fore and hinder-ends of the *Letter*, and *Rubbing* the *Letter* pretty lightly backwards about eight or nine Inches, they bring it forwards again with an hard pressing *Rub* upon the *Stone*; where the fore-Finger and Thumb of the left-Hand is ready to receive it, and quickly turn the opposite side of the *Letter*, to take such a *Rub* as the other side had.

But in *Rubbing* they are very careful that they press the Balls of their Fingers equally hard on the *Head* and *Foot* of the *Letter*. For if the *Head* and *Foot* be not equally pressed on the *Stone*, either the *Head* or *Foot* will *Drive out* when the *Letters* come to be *Composed* in the *Stick*; So that without *Rubbing* over again they cannot be *Drest*.

¶ 5. *Of Kerning of Letters.*

Amongst the *Italick-Letters* many are to be *Kern'd*, some only on one side, and some both sides. The *Kern'd-Letters* are such as have part of their *Face* hanging over one side or both sides of their *Shank*: These cannot be *Rub'd*, because part of the *Face* would *Rub* away when the whole side of the *Shank* is toucht by the *Stone*: Therefore they must be *Kern'd*, as *Founders* call it: Which to do, they provide a small Stick bigger or less, according as the *Body* of the *Letter* that is to be *Kern'd*. This *Kerning-stick* is somewhat more than an Handful long, and it matters not whether it be square or round: But if it be square the Edges of it must be pretty

ty well rounded away, lest with long usage and hard Cutting they Gall the Hand. The upper side of this *Kerning-Stick* is flattened away somewhat more than the length of the *Letter*, and on that flat part is cut away a flat bottom with two square sides like the *Sides* or *Ledges* of the *Lining-stick* to serve for two *Sholders*. That side to be *Kern'd* and *scrap'd*, is laid upwards, and its opposite side on the bottom of the *Kerning-stick* with the *Foot* of the *Letter* against the bottom *Sholder*, and the side of the *Letter* against the side *Sholder* of the *Kerning-stick*.

He also provides a *Kerning-Knife*: This is a pretty strong piece of a broken Knife, about three Inches long, which he fits into a Wooden-Handle: But first he breaks off the Back of the Knife towards the Point, so as the whole edge lying in a straight-line the piece broken off from the back to the edge may leave an angle at the point of about 45 Degrees, which irregular breaking (for so we must suppose it) he either *Grinds* or *Rubs* off on a *Grind-stone*. Then he takes a piece of a Broom-stick for his Handle, and splits one end of it about two Inches long towards the other end, and the split part he either Cuts or Rasps away about a *Brevier* deep round about that end of the Handle. Then he puts about an Inch and an half of his broken blade into the split or slit in the Handle, and ties a four or five doubled Paper a little below the Rasped part of the Handle round about it, to either a *Pica* or *Long-Primmer* thick of the slit end of the Handle. This *Paper* is so ordered that all its sides round about shall stand equally distant from all the
the

the Rasped part of the Handle: For then setting the other end of the Handle in Clay, or otherwise fastening it upright, when *Mettal* is poured in between the Rasped part of the Handle and the Paper about it, that *Mettal* will make a strong *Ferril* to the *Handle* of the *Knife*. The irregularities that may happen in *Castting* this *Ferril* may be Rasped away to make it more handy and Handsome.

Now to return again where I left off. Holding the Handle of the *Kerning-stick* in his left-Hand, He lays the side of the *Letter* to be *Kern'd* upwards with the *Face* of the *Letter* towards the end of the *Kerning-stick*: the side of the *Letter* against the side *Sholder* of the *Kerning-stick*, and the *Foot* of the *Letter* against the bottom *Sholder* of the *Kerning-stick*, and laying the end of the Ball of his left-Hand Thumb hard upon the *Shanck* of the *Letter* to keep its *Side* and *Foot* steady against the *Sholders* of the *Kerning-stick*, he with the *Kerning-Knife* in his right-Hand cuts off about one quarter of the *Mettal* between the *Beard* of the *Shanck* and the *Face* of the *Letter*. Then turning his *Knife* so as the back of it may lean towards him, he scrapes towards him with the edge of the *Knife* about half the length of that upper-side, *viz.* about so much as his Thumb does not cover: Then he turns the *Face* of the *Letter* against the lower *Sholder* of the *Kerning-stick*, and scraping fromwards him with a stroak or two of his *Knife* smoothes that end of the *Letter* also.

If the other side of the *Letter* be not to be *Kern'd*
it

it was before *Rub'd* on the *Stone*, as was fhewed in the laft ¶: But if it be to be *Kern'd*, then he makes a little hole in his *Kerning-ftick*, clofe to the lower *Sholder* of it and full deep enough to receive all that part of the *Face* of the *Letter* that hangs over the *Shanck*, that the *Shanck* of the *Letter* may lie flat and folid on the bottom of the *Kerning-ftick*, and that fo the *Shanck* of the *Letter* bow not when the weight of the Hand preffes the edge of the *Kerning-Knife* hard upon it. Into this hole he puts (as before faid) fo much of the *Face* of the *Letter* as hangs over the fide of the *Shanck*, and fo fcrapes the lower end of the *Letter* and *Kerns* the upper end, as he did the former fide of the *Letter*.

¶ 6. Of Setting up, or Compofing Letters.

I defcribed in § 5. ¶ 2. the *Lining-ftick*, But now we are come to *Setting up*, or *Compofing* of *Letters*. The *Founder* muft provide many *Compofing-fticks*; five or fix dozen at the leaft. Thefe *Compofing-fticks* are indeed but long *Lining-fticks*, about feven or eight and twenty Inches long *Handle* and all: Whereof the *Handle* is about three Inches and an half long: But as the *Lining-ftick* I defcribed was made of *Brafs*: So thefe *Compofing-fticks* are made of *Beech-Wood*.

When the Boy *Sets up Letters* (for it is commonly Boys Work) The *Cafter* *Cafts* about an hundred *Quadrats* of the fame *Body* about half an Inch broad at leaft, let the *Body* be what it will, and of the

the length of the whole *Carriage*, only by placing a flat *Brafs* or *Iron Plate* upon the *Stool* of the *Mold* close against the *Carriage* and *Body*, to stop the *Mettal* from running farther.

The Boy (I say) takes the *Composing-stick* by the *Handle* in his left-Hand, clasping it about with his four Fingers, and puts the *Quadrat* first into the *Composing-stick*, and lays the Ball of his Thumb upon it, and with the fore-Finger and Thumb of his right-Hand, assisted by his middle Finger to turn the *Letter* to a proper position, with its *Nick* upwards towards the bottom side of the *Composing-stick*; while it is coming to the *Stick*, he at the same time lifts up the Thumb of his left-Hand, and with it receives and holds the *Letter* against the fore-side of the *Quadrat*, and after it, all the *Letters* of the same sort, if the *Stick* will hold them, If not he *Sets* them in so many *Sticks* as will hold them: Observing to *Set* all the *Nicks* of them upwards, as aforesaid. And as he *Set* a *Quadrat* at the beginning of the *Composing-stick*, so he fills not his *Stick* so full, but that he may *Set* another such *Quadrat* at the end of it.

¶ 7. *Some Rules and Circumstances to be observed in Setting up Letters.*

1. If they *Drive* a little out at *Head* or *Foot*, so little as not to require new *Rubbing* again, then he holds his Thumb harder against the *Head* or *Foot*, so as to draw the *Driving* end inward: For else when they come to *Scraping*, and *Dressing* the *Hook* of the
Dref-

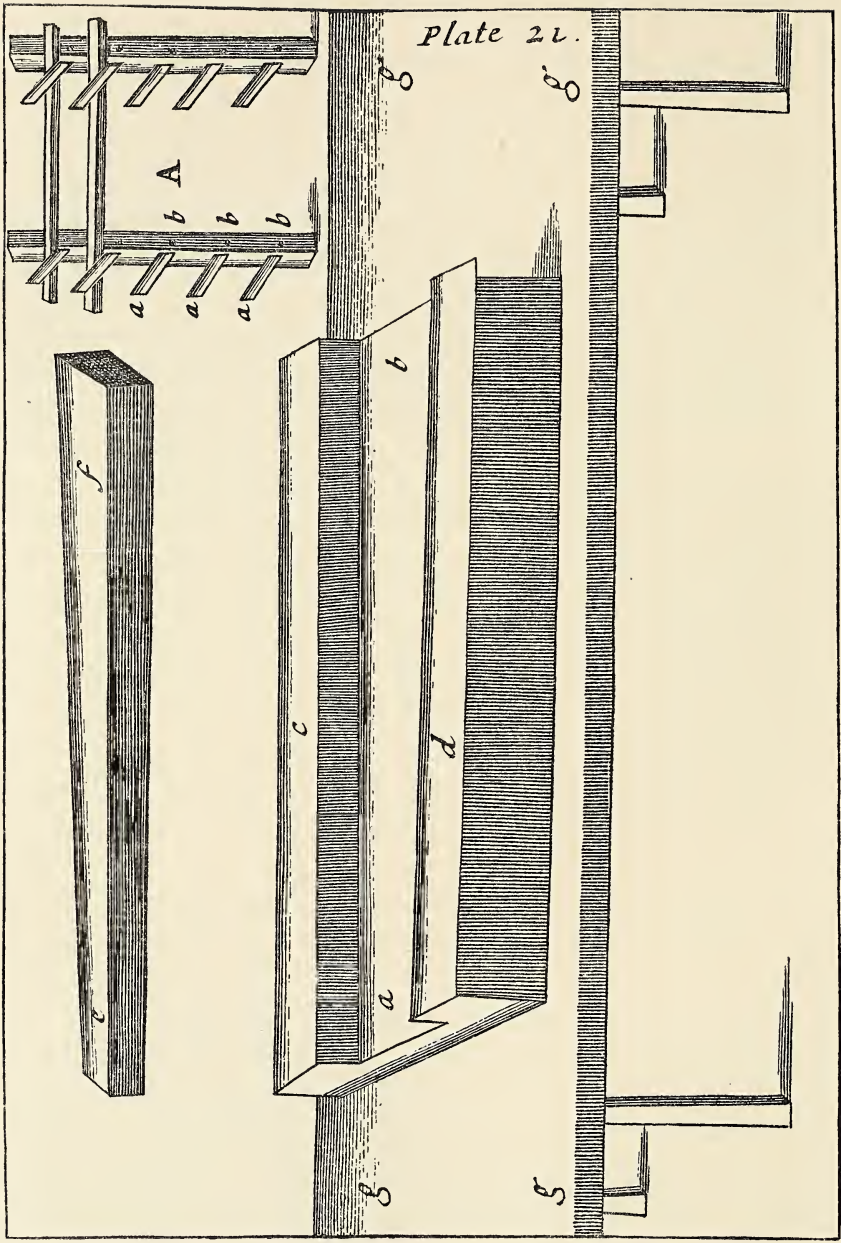
Dreffing-Hook drawing Square, will endanger the middle or some other part of *Letters* in the *Stick* to *Spring* out: And when they come into the *Dreffing-block*, the *Knots* of the *Blocks* drawing also square ſubject them to the ſame inconvenience. And if they *Drive* out at the *Head*, the *Feet* will more or leſs ſtand off one another: So that when the *Tooth* of the *Plow* comes to *Drefs* the *Feet*, it will more or leſs job againſt every *Letter*, and be apt to make a bowing at the *Feet*, or at leaſt make a *Bur* on their ſides at the *Feet*.

2. When *Short-Letters* are begun to be *Set* up in a *Stick*, the whole *Stick* muſt be fill'd with *Short-Letters*: Becauſe when they are *Dreffing*, the *Short-Letters* muſt be *Bearded* on both ſides the *Body*: And ſhould *Short-Letters* or *Ascending* or *Descending* or *Long* ſtand together, the *Short* cannot be *Bearded* becauſe the *Stems* of the *Ascending* or *Descending* or *Long-Letters* reach upon the *Body* to the *Beard*: So that the *Short-Letters* cannot be *Bearded*, unleſs the *Stems* of the other *Letters* ſhould be ſcraped off.

3. When *Long-Letters* are begun to be *Set* up in the *Stick*, none but ſuch muſt fill it, for the reaſon aforeſaid.

4. If any *Letters Kern'd* on one ſide be to be *Set* up, and the *Stems* of the ſame *Letters* reach not to the oppoſite *Beard* as *f* or *f*, in *Setting* up theſe or ſuch like *Letters*, every next *Letter* is turned with its *Nick* downwards, that the *Kern* of each *Letter* may lie over the *Beard* of its next. But then they muſt be all *Set* up again with a *Short-Letter*

Plate 21.



Letter between each, that they may be *Bearded*.

As every *Stick-full* is set up, he sets them by upon the *Racks*, ready for the *Dresser* to *Dress*, as shall be shewed in the next §.

The *Racks* are described in *Plate 21.* at A. They are made of Square *Deal Battens* about seven Inches and an half long, as at *a b a b a b*, and are at the ends *b b b* let into two upright *Stiles*, standing about sixteen Inches and an half asunder, and the fore-ends of the *Racks* mounting a little, that when *Sticks* of *Letters* is *Set* by on any two parallel *Racks*, there may be no danger that the *Letters* in them shall slide off forward; but their *Feet* rest against the *Bottom-Ledges* of the *Composing-sticks*. They set by as many of these *Sticks* with *Letter* in them, as will stand upon one another between every two *Rails*, and then set another pile of *Sticks* with *Letter* in them before the first, till the length of the *Rail* be also filled with *Sticks* of *Letter* before one another. They set all the *Sticks* of *Letters* with their ends even to one another with the *Faces* of the *Letter* forwards.

This *Frame of Racks* is always placed near the *Dressing-Bench*, that it may stand convenient to the *Letter-Dressers* Hand.

§ 20. ¶ 1. *Of Dressing of Letters.*

There be several Tools and Machines used to the *Dressing* of *Letters*: And unless I should describe them to you first, you might perhaps in my following discourse not well understand me:

me: Wherefore I shall begin with them: They are as follows.

1. The *Dressing-Sticks*.
2. The *Bench, Blocks* and its Appurtenances.
3. The *Dressing-Hook*.
4. The *Dressing-Knife*.
5. The *Plow*.
6. The *Mallet*.

Of each of these in order.

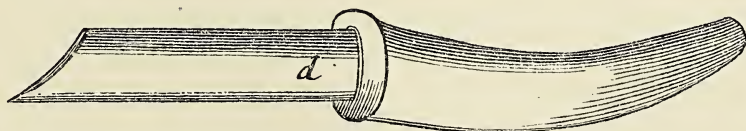
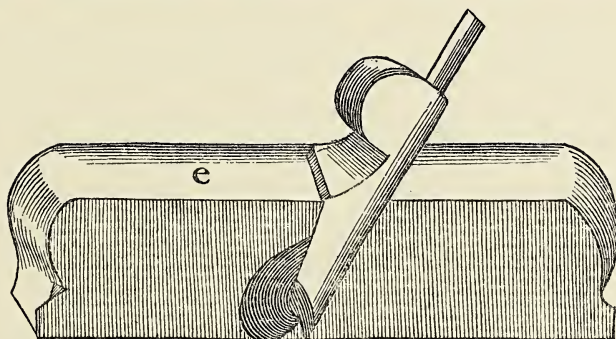
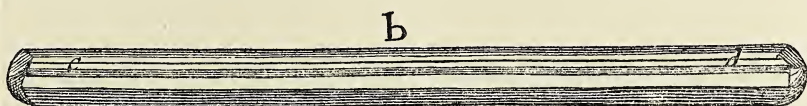
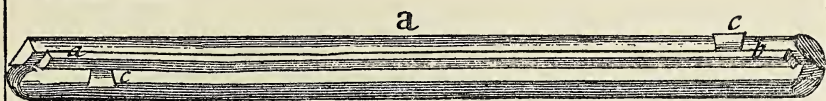
¶ 2. Of the *Dressing-Sticks*.

I need give no other Description of the *Dressing-Sticks*, than I did in the last § and ¶ of the *Composing-Sticks*: Only they are made of hard Wood, and of greater Substance, as well because hard Wood will work smoother than soft Wood, as because greater Substance is less Subject to warp or shake than smaller Substance is. And also because hard Wood is less Subject to be penetrated by the sharpness of the *Bur* of the *Mettal* on the *Letters* than the soft.

¶ 3. Of the *Block-Grove*, and its Appurtenances.

The *Block-Grove* is described in *Plate 21. a b* The *Groove* in which the *Blocks* are laid, two Inches deep, and seven Inches and an half wide at one end, and seven Inches wide at the other end: One of the *Cheeks* as *c* is three Inches and an half broad at one end, and three Inches broad at the other end, and the other *Cheek* three Inches broad the whole
Length

Plate 22.



Length: The Length of these *Cheeks* are two and twenty Inches.

The *Wedge e f* is seven and twenty Inches and an half long, two Inches broad at one end, and three Inches and an half broad at the other end; And two Inches deep.

g g g g The *Bench* on which the *Dressing-Blocks* are placed, are about sixteen Inches broad, and two Foot ten Inches high from the Floor. The *Bench* hath its farther Side, and both ends, railed about with slit Deal about two Inches high, that the *Hook*, the *Knife*, and *Plow*, &c. fall not off when the Work-man is at Work.

The *Blocks* are described in *Plate 21* at *a b*: They are made of hard Wood. These *Blocks* are six and twenty Inches long, and each two Inches square. They are *Male* and *Female*, *a* the *Male*, *b* the *Female*: Through the whole Length of the *Male-Block* runs a *Tongue* as at *a b*, and a *Groove* as at *c d*, for the *Tongue* of the *Plow* to run in; This *Tongue* is about half an Inch thick, and stands out square from the upper and under sides of the *Block*. About three Inches within the ends of the *Block* is placed a *Knot* as at *c c*: These *Knots* are small square pieces of *Box-wood*, the one above, and the other below the *Tongue*.

The *Female Block* is such another *Block* as the *Male Block*, only, instead of a *Tongue* running through the length of it a *Groove* is made to receive the *Tongue* of the *Male-Block*, and the *Knots* in this *Block* are made at the contrary ends, that when the *Face* of a *Stick of Letter* is placed on the
Tongue

Tongue the *Knot* in the *Male-Block* stops the *Stick* of *Letter* from fliding forwards, while the other *Knot* in the *Female-Block* at the other end, by the knocking of a *Mallet* on the end of the *Block* forces the *Letter* between the *Blocks* forwards, and fo the whole *Stick* of *Letters* between thefe two *Knots* are fcrewzed together, and by the *Wedge e f* in *Plate 21* (alfo with the force of a *Mallet*) *Wedges* the two *Blocks* and the *Stick* of *Letter* in them alfo tight, and clofe between the fides of the two *Blocks*; that afterwards the *Plow* may more certainly do its Office upon the *Foot* of the *Letter*; as fhall be fhewed hereafter.

¶ 3 *Of the Dreſſing-Hook.*

The *Dreſſing-Hook* is deſcribed in *Plate 21* at c. This is a long ſquare *Rod* of *Iron*, about two Foot long and a *Great-Primmer* ſquare: Its end *a* is about a *two-Lin'd* *English* thick, and hath a ſmall *Return* piece of *Iron* made ſquare to the under-fide of the *Rod*, that when the whole *Dreſſing-Hook* is laid along a *Stick* of *Letter*, this *Return* piece or *Hook* may, when the *Rod* is drawn with the *Ball* of the Thumb, by the *Knot* on the upper fide of it at c, draw all the *Letter* in the *Stick* tight and clofe up together, that the *Stick* of *Letter* may be *Scraped*, as fhall be fhewed.

¶ 4 *Of*

¶ 4 *Of the Dressing-Knife.*

The *Dressing-Knife* is delineated at d in *Plate. 21*. It is only a short piece of a *Knife* broken off about two Inches from the *Sholder*: But its Edge is *Bafil'd* away from the back to the point pretty suddenly to make it the stronger: The *Sprig* or *Pin* of the *Handle* is commonly let into an Hole drilled into a piece of the Tip of an Harts-horn, as in the Figure and is fastned in with *Rosen*, as other *Knives* are into their *Handles*.

¶ 5 *Of the Plow.*

The *Plow* is delineated in *Plate 21* at e: It is almost a common *Plain* (which I have already described in *Vol. 1. Numb. 4. Plate 4. and § 2 to 9.*) only with this distinction, that through the length of the *Sole* runs such a *Tongue*, as does through the *Male-Block* to slide tight and yet easily through the *Groove* made on the top of the *Male-block*: Its *Blade* makes an *Angle* of 60 Degrees with the *Sole* of it.

§ 21. ¶ 1. *Of Dressing of Letters.*

THE *Letter Dresser* hath (as I told you before) his *Letter Set* up in *Composing-sticks*, with their *Nicks* upwards, and those *Sticks* set upon the *Racks*: Therefore he takes one *Stick* off the *Racks*, and placing the *Handle* of the *Composing-stick* in his left-hand, he

he takes the contrary end of the *Dressing-stick* in his right-hand, and laying the Back of the *Dressing-stick* even upon or rather a little hanging over the Back of the *Composing-stick*, that the *Feet* of the *Letter* may fall within the *Bottom-Ledge* of the *Dressing-stick*; He at the same time fits the *Side-Ledge* of the *Dressing-stick* against the farther end of the *Line* of *Letters* in the *Composing-stick*: And holding then both *Sticks* together, his left-Hand at the *Handle-end* of the *Composing-stick*, and his right-Hand within about two Handfuls of the *Handle-end* of the *Dressing-stick*, He turns his Hands, *Sticks* and all, outward from his left-Hand, till the *Composing-stick* lies flat upon the *Dressing-stick*, and consequently the *Letters* in the *Composing-stick* is turned and laid upon the *Dressing-stick*.

Then he goes as near the Light as he can with the *Letters* in his *Dressing-stick*, and examines what *Letters Come not well* either in the *Face* or *Shanck*: So that then holding the *Dressing-stick* in his left-Hand, and tilting the *Bottom-Ledge* a little downward, that the *Feet* of the *Letter* may rest against the *Bottom-Ledge*, and laying the Ball of his Thumb upon any certain Number of *Letters* between his *Body* and the *Letter* to be *Cast out*, He with the *Foot* of a *Space* or some thin *Letter*, lifts up the *Letter* to be *Cast out*, and lets it fall upon the *Dressing-Bench*: and thus he does to all the *Letters* in that *Stick* that are to be *Thrown out*.

Then taking again the *Dressing-Stick* in his left-Hand at or near the handle of it, he takes the *Dressing-Hook* at the *Knot*, between the fore-Finger and
Thumb

Thumb of his right-Hand, and laying the *Hook* over the edge of the *Quadrat* at the farther end of the *Dressing-stick*, near the *bottom-Ledge* of it, he slips his right-Hand to the *Handle* of the *Dressing-stick*, and his left-Hand towards the middle of the *Dressing-stick*, so as the end of the Ball of his Thumb may draw by the farther end of the *Knot* on the *Dressing-Hook* the whole *Dressing-Hook*, and the *Hook* at the end of it the whole *Stick* of *Letter* close together towards him; While at the same time he with his Fingers clutched about the *Stick* and *Letter*, and the Thumb-ball of his Hand presses the under flat of the *Hooking-stick* close against the *Letter* and *Dressing-stick*, that the *Letter* in the *Stick* may lie fast and manageable.

Then he takes the *Handle* of the *Dressing-Knife* in his right-Hand, and inclining the back of it towards his *Body*, that its *Basil-edge* may *Cut* or *Scrap* the smoother, He *Scrapes* twice or thrice upon so much of the whole *Line* of *Letters* as lies between the outer-side of the *Dressing-Hook* and the *Face* of the *Letter*.

But if twice or thrice *Scraping*, have not taken all the *Bur* or irregularities off so much of the *Letter* as he *Scraped* upon, he *Scrapes* yet longer and oftner till the whole number of *Letters* in the *Dressing-stick* from end to end seems but one intire piece of *Mettal*.

Thus is that side of the fore-part (*viz.* that part towards the *Face*) of the *Shanck* of the *Body* finisht.

To *Scrape* the other end of that side of the *Letter*
ter

ter, viz. that towards the *Feet*; He turns the *Handle* of the *Stick* from him, and removing the *Dressing-Hook* towards the *Face* of the *Letter* which is already *Scraped*, he places his Thumb against the *Knot* of the *Dressing-Hook*, and presses it hard from him, that the *Hook* of the *Dressing-Hook* being now towards him, may force the whole *Stick* of *Letter* forwards against the *Side-Ledge* of the *Dressing-stick*; that so the whole *Line* in the *Stick* may lie again the faster and more manageable: Then he *Scrapes* with the *Dressing-Knife* as before, till the end of the *Shanck* of the *Letter* towards the *Feet* be also *Drest*.

Then he lays by his *Dressing-Hook*, and keeping his *Dressing-stick* of *Letter* still in his left-Hand, he takes a second *Dressing-stick*, with its *Handle* in his right-Hand, and lays the *Side-Ledge* of it against the hither side of the *Quadrat* at the hither end of the *Dressing-stick*, and the *bottom-Ledge* of the second *Stick* hanging a little over the *Feet* of the *Letter*, that they may be comprehended within the *bottom-Ledge* of the second *Dressing-stick*; and so removing his left-Hand towards the middle of both *Dressing-sticks*, and clasping them close together, he turns both Hands outwards towards the left, till the *Letter* in the first *Dressing-stick* lie upon the second *Dressing-stick*, and then the *Face* of the *Letter* will lie outwards toward the right-Hand, and the *Nicks* upwards. Then he uses the *Dressing-Hook* and *Dressing-Knife* to *Scrape* this side the *Line* of *Letter*, as he did before to the other side of the *Line* of *Letter*: So shall both sides be *Scraped* and *Drest*.

Having thus *Scraped* both the sides, He takes the
Handle

Handle of the *Dressing-stick* into his left-Hand, as before, and takes the *Male-block* into his right-Hand, and placing the *Tongue* of the *Block* against the *Face* of the *Letter* in the *Dressing-stick*, he also places the *Knot* of the *Block* against the farther side of the *Quadrat* at the farther end of the *Stick*, and so placing his right-Hand underneath the middle of the *Dressing-stick* and *Block*, he turns his Hand outwards towards the left, as before, and transfers the *Letter* in the *Dressing-stick* to the *Male-Block*: Yet he so holds and manages the *Block* that the *Shanck* of the *Letter* may rest at once upon the side of the *Block* the *Knot* is placed in, and the *Face* of the *Letter* upon the *Tongue*.

When his *Stick* of *Letters* is thus transfer'd to the *Male-Block*, He claps the middle of the *Male-Block* into his left-Hand, tilting the *Feet* of the *Letter* a little upwards, that the *Face* may rest upon the *Tongue*, and then takes about the middle of the *Female-Block* in his right-Hand, and lays it so upon the *Male-Block*, that the *Tongue* of the *Male-Block* may fall into the *Tongue* of the *Female-Block*, and that the *Knot* at the hither end of the *Female Block* may stand against the hither side of the *Quadrat* at the hither end of the *Line* of *Letters*: So that when the *Knot* of the *Male-Block* is lightly drawn towards the *Knot* of the *Female-Block*, or the *Knot* of the *Female-Block* lightly thrust towards the *Knot* of the *Male-Block*, both *Knots* shall squeeze the *Letter* close between them.

Then he grasps both *Blocks* with the *Letter* between them in both his Hands, and lays them in
the

the *Block-Groove*, with the *Feet* of the *Letter* upwards, and the hither side of the hither *Block* against the hither *Cheek* of the *Block-Groove*. And putting the *Wedge* into the vacant space between the *Blocks* and the further *Cheek* of the *Block-Groove*, he lightly with his right-Hand thrusts up the *Wedge* to force the *Blocks* close together, and pinch the *Letter* close between the *Blocks*.

Then with the *Balls* of the *Fingers* of both his *Hands*, he Patts gently upon the *Feet* of the *Letter*, to press all their *Faces* down upon the *Tongue*; which having done, he takes the *Mallet* in his right-Hand, and with it knocks gently upon the head of the *Wedge* to pinch the *Letter* yet closer to the insides of the *Blocks*. Then he Knocks lightly and successively upon the *Knot-ends* of both the *Blocks*, to force the *Letters* yet closer together. And then again knocks now pretty hard upon the head of the *Wedge*, and also pretty hard upon the *Knot-ends* of the *Blocks*, to Lock the *Letter* tight and close up.

Then he places the *Tongue* of the *Plow* in the upper *Groove* of the *Block*; And having the *Tooth* of the *Iron* fitted in the *Plow*, so as to fall just upon the middle of the *Feet* of the *Letter*, he grasps the *Plow* in his right-Hand, placing his *Wrist-Ball* against the *Britch* of it, and guiding the fore-end with his left-Hand, slides the *Plow* gently along the whole length of the *Blocks*; so as the *Tooth* of the *Iron* bears upon the *Feet* of the *Letter*: And if it be a small *Letter* he *Plows* upon, the *Tooth* of the *Iron* will have cut a *Groove* deep enough through the length of the whole *Block* of *Letters*:

ters: But if the *Body* of the *Letter* be great, he reiterates his *Traverses* two three or four times according to the Bigness of the *Body* of the *Letter*, till he have made a *Groove* about a *Space* deep in the *Feet* of the *Shancks* of the whole *Blocks* of *Letter*, and have cut off all the irregularities of the *Break*.

Then with a small piece of *Buff* or some other soft *Leather*, he rubs a little upon the *Feet* of the *Letter* to smoothen them.

Then he unlocks the *Blocks* of *Letter*, by knocking with the *Mallet* upon the small end of the *Wedge*, and first takes the *Wedge* from between the *Blocks* and *Cheeks*, and lays it upon the farther *Cheek*, and afterwards takes the *Blocks* with *Letter* in it near both ends of the *Blocks* between the *Fingers* and *Thumbs* of both his *Hands*, and turns the hithermost *Block* upon the hithermost *Cheek*, and with his *Fingers* and *Thumbs* again lifts off the upper *Block*, leaving the *Letter* on the undermost *Block* with its *Face* against the *Tongue*.

Then taking the *Block* with *Letter* in it in his left-Hand, he places the *Knot-end* from him, and takes the *Handle* of the *Dressing-stick* in his right-Hand, and lays the *Side-Ledge* of it against the hither side of the *Quadrat* at the hither end, and the *Bottom-ledge* against the *Feet* of the *Letter*, he grasps the *Handle* of the *Dressing-stick* *Block* and all in his left-Hand, and lays his right-Hand Thumb along the under side of the *Dressing-stick* about the middle, and with the *Fingers* of the same Hand grasps the *Block*, and turning his *Hands*, *Block*, and *Dressing-stick* to the right, transfers the *Letter* in the *Block* upon the *Dressing-stick*.
Then

Then grasping the *Dressing-stick* by the *Handle* with his left-Hand, he with his right-Hand takes the *Dressing-Hook* by the *Knot*, and lays the inside of the *Hook* of it against the farther side of the *Quadrat* at the farther end of the *Stick*, and drawing the *Hook* and *Letter* in the *Dressing-stick* with his left Thumb by the *Knot* close up toward him, he resting the *Stick* upon the *Dressing-bench* that he may *Scrape* the harder upon the *Beard* with the Edge of the *Dressing-Knife*, *Scrapes* off the *Beard* as near the *Face* as he dares for fear of spoiling it, and about a Thick *Space* deep at least into the *Shanck*.

If the Bottom and Top are both to be *Bearded*, He transfers the *Letter* into another *Dressing-stick*, as hath been shewed, and *Beards* it also as before.

¶ 2. *Some Rules and Circumstances to be observed in Dressing of Letters.*

1. The *Letter-Dresser* ought to be furnished with three or four sorts of *Dressing-sticks*, which differ nothing from one another save in the Height of their *Ledges*. The *Ledges* of one pair no higher than a *Scaboard*. This pair of *Sticks* may serve to *Dress*, *Pearl*, *Nomparel*, and *Brevier*. Another pair whose *Ledges* may be a *Nomparel* high. And this pair of *Dressing-sticks* will serve to *Dress* *Brevier*, *Long-Primmer*, and *Pica*: Another pair whose *Ledges* may be a *Long-Primmer* high: And these *Dressing-sticks* may serve to *Dress* *Pica*, *English*, *Great-Primmer*, and *Double-Pica*. And if you will another pair of *Dressing-*

Dressing-sticks, whose *Ledges* may be an *English* High: And these *Dressing-sticks* may serve to *Dress* all big Bodied *Letters*, even to the Greatest.

2. As he ought to be furnisht with several sorts of *Dressing-sticks* as aforesaid: So ought he also to be furnisht with several *Blocks*, whose *Knots* are to correspond with the Sizes of the *Ledges* of the *Dressing-sticks*, for the *Dressing* of several *Bodies* as aforesaid.

3. He ought to be furnisht with three or four *Dressing-Hooks*, whose *Hooks* ought to be of the several Depths aforesaid, to fit and suit with the several *Bodied-Letters*.

4. He must have two *Dressing-Knives*, one to lie before the *Blocks* to *Scrape* and *Beard* the *Letter* in the *Sticks*, and the other behind the *Dressing-blocks* to use when occasion serves to *Scrape* off a small *Bur*, the *Tooth* of the *Plow* may have left upon the *Feet* of the *Letter*. And though one *Dressing-Knife* may serve to both these uses: Yet when Work-men are in a Train of Work they begrutch the very turning the Body about, or stepping one step forward or backward; accounting that it puts them out of their Train, and hinders their riddance of Work.

5. For every *Body* of *Letter* he is to have a particular *Plow*, and the *Tooth* of the *Iron* of each *Plow* is to be made exactly to a set bigness, the measure of which bigness is to be taken from the size of the *Break* that is to be *Plowed* away. For Example, If it be a *Pearl Body* to be *Plowed*, the breadth of the *Tooth* ought not to be above a thin *Scaboard*: Because the *Break* of that *Body* cannot be bigger, for Reasons I have

have given before; But the *Tooth* must be full broad enough, and rather broader than the *Break*, lest any of the irregularity of the *Break* should be left upon the *Foot* of the *Letter*. And so for every *Body* he fits the *Tooth* of the *Iron*, full broad enough and a little broader than the size of the *Break*. This is one reason why for every particular *Body* he ought to have a particular *Plow*. Another reason is.

The *Tooth* of this *Plow* must be exactly set to a punctual distance from the *Tongue* of the *Plow*: For if they should often shift *Irons* to the several *Stocks* of the *Plow*, they would create themselves by shifting more trouble than the price of a *Stock* would compensate.

A *Fount* of *Letter* being new *Cast* and *Drest*, the *Boy Papers* up each sort in a *Cartridge* by it self, and puts about an hundred Pounds weight, viz. a *Porters* Burthen into a *Basket* to be sent to the *Master-Printers*.

The *Steel-Punches* being now *Cut*, the *Molds* made, the *Matrices Sunk*, the *Letters Cast*, and *Drest*, the application of these *Letters* falls now to the task of the *Compositer*; whose *Trade* shall be (God willing) the Subject of the next *Exercises*.

F I N I S.



